Multi-County Goods Movement Action Plan

Technical Memorandum 6b:
Evaluation of Detailed Goods Movement Strategies

Prepared for:

Los Angeles County Metropolitan Transportation Authority
California Department of Transportation
Orange County Transportation Authority
Riverside County Transportation Commission
San Bernardino Associated Governments
Southern California Association of Governments
Ventura County Transportation Commission
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FIGURES

TABLES

Introduction

Technical Memorandum 6b (Tech Memo 6b) continues with the evaluation of goods movement projects and strategies first introduced in Tech Memo 6a, which is part of Task 6 of the Multi-County Goods Movement Action Plan (MCGMAP). The purpose of this task is to identify and investigate a wide range of transportation options to address the identified issues, challenges and problems related to goods movement within the MCGMAP Region. The identification and investigation of transportation options will result in a refined list of projects and strategies that will be incorporated into the Action Plan. This Tech Memo outlines the second of two phases to identify and investigate the various projects and strategies that will be refined for incorporation into the Action Plan.

This Tech Memo documents the detailed evaluation of a refined list of projects and strategies first presented in Tech Memo 6a. As discussed in Tech Memo 6a, the detailed evaluation focuses on those projects and strategies that can be quantifiably evaluated using analytical tools (such as travel demand models, economic models, and GIS tools). The methodology for detailed evaluation (including the type and application of travel demand modeling and other software) was determined through the coordination of a Modeling Working Group. The Modeling Working Group was composed of members of the TAC, key modeling staff from the various project partners, as well as consultant staff working for project partners on various modeling components. The Modeling Working Group met a number of times in the late summer and fall of 2006 to identify 1) the approach to detailed evaluations, 2) the methodology for detailed evaluations, and 3) the specific strategies/projects for detailed evaluations. It is understood that there are many tools available to model a variety of projects and strategies. For the purposes of this project, the Modeling Working Group identified a set of projects and strategies for evaluation using the Regional Travel Demand Model. The initial objective was to perform a detailed evaluation of a set of projects and strategies that would have regional effects and could be compared across consistent criteria.

Purpose of Detailed Evaluation of Projects

The purpose of the detailed evaluation is to answer the following questions, initially raised in the MCGMAP's scope of work:

- To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?
  - This will be answered by comparing the system performance of the bundles that include dedicated truck lanes.
- What portion of dedicated truck lane costs could be offset by user financing, and what additional revenues or funding sources would be needed to support dedicated truck lanes?

    - This will be answered through an evaluation of toll revenue generation potential, described in Chapter 3.
- What policy changes would facilitate or enhance truck lane feasibility? (e.g., LCV's, mandatory use, etc.)?
    - This will be answered through an evaluation of LCV operations, described in Chapter 3.
- Can dedicated truck lanes offer sufficient benefits to be a preferable alternative to other ways of accommodating increased freight traffic (such as adding mixed-flow lanes, adding rail capacity, etc.)?
    - This will be answered by comparing the system performance of the dedicated truck lane bundles to the system performance of the mixed-flow (Bundle 1), alternative technology (Bundle 11), and mixed-flow toll expressway (Bundle 10) bundles.
- What may be the differential effects of the construction of truck lanes on different sub-regions (i.e. the specific types of benefits and impacts that may occur to different sub-regions, depending on facility location)?
    - This will be answered by comparing impacts of truck lane bundles across subregions (defined as segments of each bundle route through the MCGMAP Region).

Following the detailed evaluation, a list of projects and strategies with associated evaluation results (both detailed and qualitative) will be available for use in the MCGMAP. The Action Plan will be developed with an understanding of the projects and strategies, and the evaluation results will provide the means for comparison.

Role of Scenarios in Project and Strategy Evaluation

As first introduced in Tech Memo 6a, the projects and strategies discussed in this Tech Memo represent options above and beyond those options currently included in the committed funding plans of the MCGMAP project partners. As discussed in Tech Memo 4a, the committed funding plans of the MCGMAP project partners represent one of the four scenarios investigated as a part of the MCGMAP. The scenarios (from Tech Memo 4a) are:

- Scenario 1: High Growth - Current Investment Levels
- Scenario 2: Low Growth – Current Investment Levels
- Scenario 3: Moderate Growth - Current Investment Levels
- Scenario 4: High Growth - Full Investment Levels

Specifically, the committed funding plans of the MCGMAP project partners represent the "current investment levels" specified under Scenarios 1, 2, and 3.

The "full investment levels" would require additional investment beyond the existing committed funding plans of the MCGMAP project partners; which is exactly what this Tech

Memo summarizes. Therefore, the projects and strategies described in this Tech Memo are assumed to be implemented under Scenario 4: High Growth - Full Investment Levels.

Note that under the "current investment level" scenarios, the MCGMAP Region's infrastructure and goods movement system would perform differently. As summarized in Tech Memo 4b, future highway and rail system performance will deteriorate if the "high growth" of international container cargo occurs while maintaining "current investment levels." When the existing system performance is reviewed, as summarized in Tech Memo 3, it is clear that the existing system performs at constrained levels under significant daily and peak hour congestion. Therefore, it can be concluded that if "current investment levels" are maintained, any additional growth in highway and rail volumes will result in further degraded system performance as well as the associated environmental and community impacts. Tech Memo 4a clearly showed that even if the significant growth in international container cargo is offset through diversion to other Ports or other factors (e.g., changes in trade policy, global unrest), there would still be growth at the Ports of Los Angeles and Long Beach and associated growth in volumes on the MCGMAP Region's rail and highway system. In conclusion, the scenarios assuming "current investment levels" would result in impacts to both system performance and the MCGMAP Region's environment and communities.

This Tech Memo also presents a summary analysis of the economic and system conditions under the other scenarios representing the committed funding plans of the MCGMAP project partners (i.e. Scenarios 1, 2, and 3). The summary of the regional economic impact of Scenarios 1, 2, and 3 is presented in the following chapters.

Chapter 1 – System Performance and Regional Economic Impact of the Scenarios

The concept of four Scenarios representing various trade growth and investment levels was first presented in Tech Memo 4a. The purpose of scenarios is to help stakeholders collaborate and to make strategic decisions about their future, and to identify and investigate a wide range of transportation options to address the identified issues, challenges and problems related to goods movement within the MCGMAP Region. The scenarios represent a range of future outcomes and provide a framework for evaluating and determining specific strategies.

In this Tech Memo, the Scenarios are presented with an accompanying discussion of their respective systems performance and economic impacts. For the purposes of this project, three of the four scenarios represent current investment levels, and therefore do not include assumptions for additional investment (and associated projects) above already committed funding plans. Therefore, in order to accurately evaluate projects and strategies for goods movement, only a scenario that assumes additional investment above already committed funding plans can be used.

The discussion of Scenarios 1, 2, and 3 below will show the effects of changes to forecast trade volumes on the existing goods movement system with no additional investment beyond committed funding levels. The discussion of Scenario 4 will therefore highlight the performance of various projects and strategies that will require additional investment.

As described in Tech Memo 4a, the Scenarios are based on the following assumed changes to the forecast trade volumes through the Ports of Long Beach and Los Angeles:

- Scenario 1: High Growth - Current Investment Levels
  - Assumes port throughput will increase as currently projected.
  - Assumes 42.5 million TEUs annually in 2030.
- Scenario 2: Low Growth – Current Investment Levels
  - Assumes growth will be limited to 33% of the base line growth.
  - This results in 24 million TEUs in 2030, calculated as follows:
    - The net change between the 2005 level of 14.2 million TEUs and the base case forecast of 42.5 million TEUs is 28.3 million TEUs.
    - 33% of 28.3 million TEUs is 9.3 million TEUs.
    - 9.3 million added to the 2005 base of 14.2 million is 23.5 million TEUs, or 24 million TEUs, rounded up to the nearest million.
- Scenario 3: Moderate Growth - Current Investment Levels
  - Assumes growth will be limited to 66% of the base line growth.
  - This results in a lower forecast for 2030 of approximately 33 million TEUs, calculated as follows:
    - The net change between the 2005 level of 14.2 million TEUs and the base case forecast of 42.5 million TEUs is 28.3 million TEUs.
    - 66% of 28.3 million TEUs is 18.7 million TEUs.

    - 18.7 million added to the 2005 base of 14.2 million is 32.9 million TEUs, or 33 million TEUs, rounded up to the nearest million.
- Scenario 4: High Growth - Full Investment Levels
    - Assumes port throughput will increase as currently projected.
    - Assumes 42.5 million TEUs annually in 2030

The purpose of evaluating the system performance and regional economic impact of the Scenarios is to begin to answer the question "To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?"

System Performance under Scenario 1

As first defined in Tech Memo 4a, Scenario 1 represents future conditions assuming container volumes through the San Pedro Bay ports triple from 14.2 million TEUs in 2005 to 42.5 million TEUs by 2030[1] while maintaining the current level of investment for the MCGMAP Region's highway and rail system. The performance of the MCGMAP Region's system is summarized in Tech Memo 4b. Tech Memo 4b concludes that the future performance of the MCGMAP study area's rail and highway network is directly linked to the substantial increase in volumes forecast. As shown in Tech Memo 4a, both freight and passenger volumes are forecast to increase on all MCGMAP study area rail lines and highways. Current planning efforts have identified a number of required improvements to accommodate baseline future conditions; however, the system will still face performance challenges.

On the MCGMAP study area rail lines, increased freight volumes to and from the Ports of Los Angeles and Long Beach combined with increased passenger rail service along already congested lines will lead to potential delays along the rail network. The delays would increase on the BNSF freight line from 32 minutes in 2000 to 206 minutes by 2010 and on the UP freight line from 30 minutes in 2000 to 197 minutes by 2010 per train. These delays will impact both passenger service and freight supply chains. Planning efforts are underway; however, there is still an identified capacity constraint in terms of the number of tracks available and the demand for both passenger and freight service along shared lines.

The MCGMAP study area highways will see a similar increase in both freight and passenger volumes. The baseline forecasts for the SCAG region show approximately 3,096,000 truck trips per day. Truck trips would account for approximately 39,482,000 vehicle miles of travel (VMT) per day out of the approximately 508,807,000 VMT for all vehicles. Significant delays and capacity constraints will occur along portions of I-5, I-405, I-15, I-215, SR-14, I-10, I-710, SR-60, US-101, and I-110. The performance measures discussed in this report take into account baseline improvements identified through recent planning efforts; however, it is clear that substantial congestion and delays would continue to persist without improving system capacity.

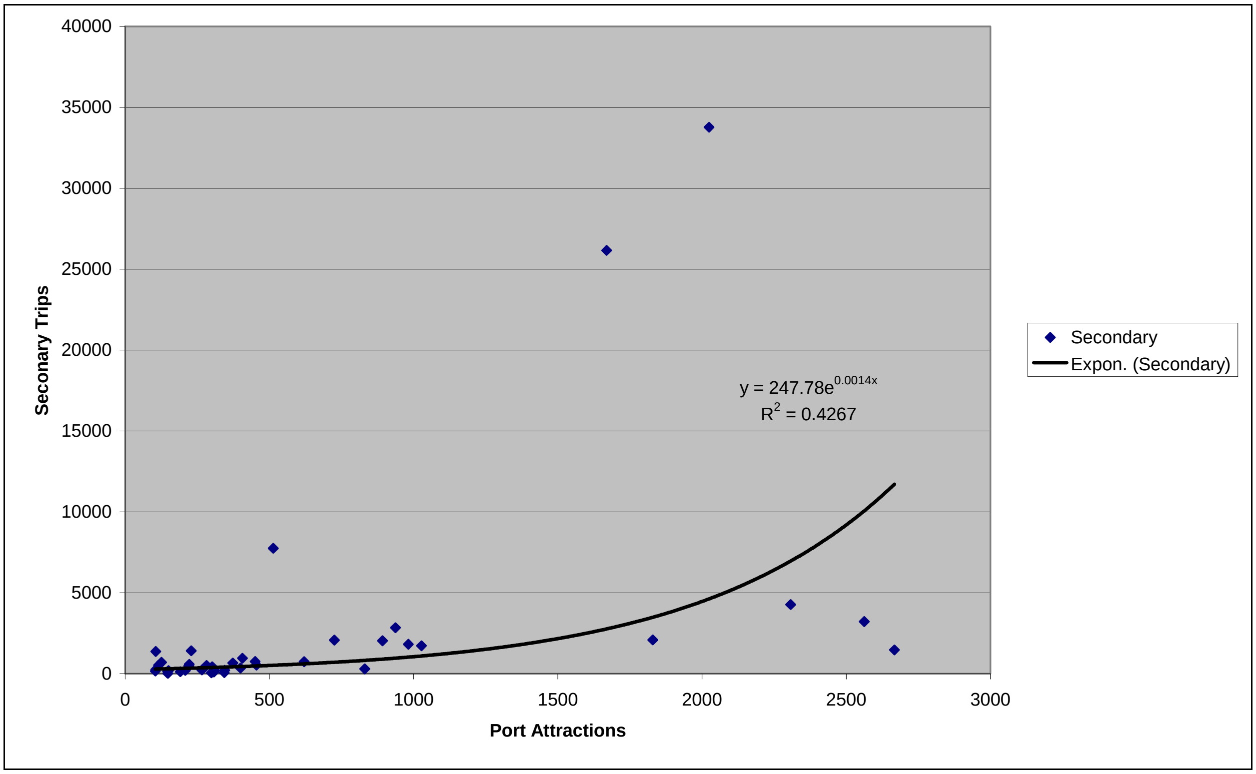
System Performance under Scenarios 2 and 3

An important question stemming from the development of the lower trade scenarios is whether lower than expected trade volumes will have a sustainable impact on the study area's transportation system. In order to evaluate the performance of the highway and rail systems as a result of the low to moderate trade forecasts under Scenarios 2 and 3, respectively, it is critical to determine whether there is a relationship between the San Pedro Bay Port trade volumes and regional truck trips. Heavy truck trips that are generated (produced) at the same zone as the attraction for heavy truck trips from the port are considered secondary truck trips. An example of this would be a truck that travels from the San Pedro Bay ports with a loaded container, stops at a warehouse location in the Inland Empire to unload the container, and the goods within the container are then separated and transferred to a number of other trucks for regional or local delivery; the truck trips for regional or local delivery would be classified as secondary trips.

Based on an evaluation of port-related and secondary trips at various zones, there is no direct linkage (currently) between travel demand model generated regional truck traffic and San Pedro Bay Port trade volume forecasts, as is shown in the following graph. Therefore, application of a travel demand forecasting model was not available as an evaluation method for the systems performance of Scenarios 2, and 3.

Figure 1 below clearly shows the lack of a direct relationship between the number of port-related truck trips into a location (port trip attractions) compared to the non-port-related truck trips leaving a location (secondary trip productions). Therefore, it would not be possible to accurately estimate the changes in total truck trips within the MCGMAP Region if the volume of truck trips to and from the San Pedro Bay ports declined (due to reduced container cargo volumes). It is assumed that a relationship between port-related truck trips and secondary truck trips exists; however, without technical linkage, no quantifiable analysis can be completed.

Figure 1
Travel Demand Model Truck Trip Evaluation
Port Trip Attractions vs. Secondary Trip Productions



Source: Wilbur Smith Associates, 2007.

The lack of a direct linkage (currently) between travel demand model generated regional truck traffic and San Pedro Bay Port trade volume forecasts highlights the nature of goods movement by truck within the MCGMAP Region. Although port-related truck traffic is substantial, especially closer to the San Pedro Bay Ports, it is not the only generator of truck traffic in the study area. A substantial amount of truck traffic within the study area is dedicated to local and regional delivery of domestic cargo; therefore, changes in port container cargo volumes would have little direct effect.

Later in this Tech Memo, the systems performance of a strategy to reduce truck traffic out of the San Pedro Bay Ports is evaluated. Although not specifically related to the Scenarios described above, the systems performance discussion of a strategy to reduce port-related truck trips can provide valuable information relating to potential lower than expected trade volumes.

System Performance under Scenario 4

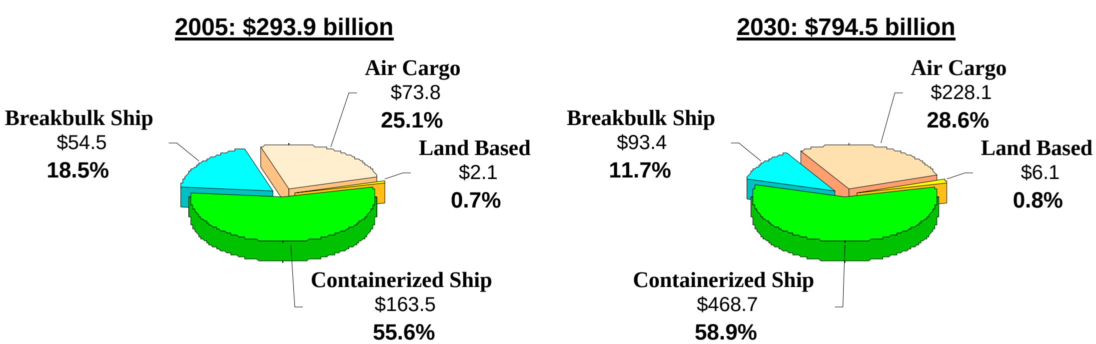
As first defined in Tech Memo 4a, Scenario 4 represents future conditions assuming container volumes through the San Pedro Bay ports reach 42.5 million TEUs by 2030 and include additional investment for the MCGMAP Region's highway and rail system. This Tech Memo documents the system performance of a number of projects and strategies that would require additional investment.

Summary of Value and Share of Trade under High Growth

Assuming that international containers grow at the current rate forecast by the Ports of Long Beach and Los Angeles, 42.5 million TEUs annually would travel through the San Pedro Bay Ports in 2030. The source and background statistics for this forecast was documented in Tech Memo 4a.

Based on an evaluation of Year 2005 trade through the San Pedro Bay Ports, as well as other regional goods movement, the following estimates of the value and share of trade in the MCGMAP region for the Year 2030 is presented below.

Figure 2
Value and Share of Trade
Los Angeles Customs District, 2005 – 2030 ($billions)



Source: Los Angeles Customs District & Economics & Politics, Inc.

Economic Impact of Scenarios

The economic data presented above was used to calculate the impact of reduced trade (e.g., Scenarios 2 and 3) on the region's job market. For the purposes of the MCGMAP, economic impact is primarily quantified in terms of direct and non-direct jobs due to trade volumes through the Ports of Long Beach and Los Angeles.

In addition to the economic impact of the scenarios in terms of job creation, it can be assumed that changes in container cargo volumes through the San Pedro Bay Ports would impact the MCGMAP Region's economy in other ways. Although there would be no difference in the cost of infrastructure to support any of the three trade growth forecasts under Scenarios 1, 2, and 3, the reduction in required transportation equipment (e.g., truck and rail) could result in reduced annual operation and maintenance costs.

Similar to the discussion of the relationship of container cargo forecasts to secondary truck trips, it is difficult to quantify the economic impacts of reduced trade forecasts in terms of sales tax and household income. The clearest linkage between trade forecasts and the MCGMAP Region's economy can be found in job creation statistics; therefore, job creation statistics are used to define economic impacts.

Economic Impact of Scenario 1: High Growth – Current Investment Levels

Under Scenario 1, Southern California's ports would support 857,000 direct jobs. Deducting for the jobs financed from within the region leaves 625,610 financed externally. Applying the multiplier yields a total of 1,370,086 jobs externally supported jobs of which 744,476 would be in the general economy. Adding these secondary jobs to direct port supported jobs, the total 2030 employment impact of trade through the ports would be 1,601,476 jobs.

Economic Impact of Scenario 2: Low Growth – Current Investment Levels

Under Scenario 2, Southern California's ports would support 542,142 direct jobs. Deducting for the jobs financed from within the region leaves 395,764. Applying the multiplier yields a total of 866,722 jobs supported externally of which 470,959 would be in the general economy. Adding these secondary jobs to direct port supported jobs, the total 2030 employment impact of trade through the ports would be 1,013,101 jobs. There would be 314,858 fewer direct port related jobs and 588,376 fewer jobs in the economy due to port growth being severely inhibited, reductions of -36.7%.

Economic Impact of Scenario 3: Moderate Growth – Current Investment Levels

Under Scenario 3, Southern California's ports would support 697,539 direct jobs. Deducting for the jobs financed from within the region leaves 509,203. Applying the multiplier yields a total of 1,115,155 jobs externally supported. Of these, 605,952 would be in the general economy. Adding these secondary jobs to direct port supported jobs, the total 2030 employment impact of trade through the ports would be 1,303,490 jobs. There would be 159,462 fewer direct port related jobs and 297,986 fewer jobs in the economy due to port growth being inhibited, reductions of -18.6%.

Economic Impact of Scenario 4: High Growth – Full Investment Levels

Scenario 4 would result in identical job creation as Scenario 1. Scenario 4 would allow for increased system performance and reliability, and the actual investment levels required to support the improved system are described in greater detail under the detailed evaluation presented in subsequent sections of this Tech Memo.

Summary of System Performance and Regional Economic Impact of Scenarios

Based on the discussions of system performance and economic impacts of the various trade growth scenarios described above, the following question can begin to be answered:

1. To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?
    a. In terms of economic benefits, it is clear that additional investment in the transportation system beyond current levels will be required in order to accommodate the forecast growth in container cargo volumes through the San Pedro Bay Ports; otherwise, the system will be constrained and will perform at less than optimal levels. The forecast growth in container cargo will result in increased truck traffic on the MCGMAP Region's highway system. Therefore, not accommodating the additional truck traffic could lead to less than expected growth in container cargo, which could lead to the reduced job creation forecasts discussed above and a related economic impact; conversely, accommodating truck traffic will lead to economic benefits.
    b. Additional analysis is included later in this Tech Memo to analyze the cost of dedicated truck lanes.
    c. This Tech Memo also shows that much more detailed information and analyses would be required in order to accurately respond to the question, particularly in the area of air quality improvements and associated costs.

[1] Ports of Long Beach and Los Angeles, 2006.

Chapter 2 – Evaluation of Projects and Modeling Results

Discussion of Detailed Evaluation of Projects

The detailed evaluation will focus on the following projects and strategies. Many of these projects and strategies will be evaluated under Scenario 4; however, some of the projects and strategies are complementary to increased trade volumes and therefore are assumed to be in place and are not expressly evaluated.

1. **Expansion of On-Dock Rail at Ports:** The Year 2030 forecast of 42.5 million TEUs through the San Pedro Bay Ports assumes maximum expansion of on-dock rail at the Ports; therefore, all detailed evaluations assume this project and strategy is in place.

2. **Additional Intermodal Facilities / Freight Yards:** Additional intermodal facilities and freight yards would be required to support the volume of goods forecast through the Ports; therefore, all detailed evaluations assume this project and strategy is in place.

3. **Implement Alternative Technologies to Additional Intermodal Terminals:** The effects of alternative technologies (e.g., non-truck systems) to link the Ports to inland intermodal terminals.

4. **Construction of Exclusive Truck Lanes:** The effects of dedicated freight guideways (e.g., exclusive truck lane systems) along major regional goods movement corridors, including between the Ports and inland destinations, from within the region to external locations, and through the region from the U.S. / Mexico border to external locations. This also includes the potential toll revenue generation.

5. **Allow Use of LCVs on Dedicated Facilities:** The effects (in terms of potential toll revenue generation) of LCVs on dedicated facilities (e.g., truck lanes or a dedicated freight guideway system).

6. **Additional Freeway Lanes/Capacity:** The effects of adding general purpose mainline capacity along regional highways. This includes HOV systems.

7. **Additional Freeway Operational/Safety Improvements:** The effects of operational / safety (e.g., auxiliary lanes, truck climbing lanes) along regional highways.

8. **Increase Port/Rail Yard Freight Capacity:** Increased port/rail yard freight capacity would be required to support the volume of goods forecast through the Ports; therefore, all detailed evaluations assume this project and strategy is in place.

The projects and strategies described above will have some measurable effect by addressing an identified congestion or mobility issue for goods movement. It is likely that a combination of complementary individual projects and strategies will be unified into a single action in order to provide maximum benefits.

In order to evaluate the projects and strategies described above, 12 bundles were identified. These bundles represent complete systems of projects and strategies and were modeled using SCAG's regional travel demand forecasting model. The 12 bundles were determined through coordination with the Modeling Working Group (described in detail in Tech Memo 6a). For the purposes of this project, the Modeling Working Group identified a set of projects and strategies for evaluation using the Regional Travel Demand Model. The initial objective was to perform a detailed evaluation of a set of projects and strategies that would have regional effects and could be compared across consistent criteria. The result is the 12 bundles summarized below:

1. Strategic freeway widening, bottleneck relief, auxiliary lanes, interchange improvements on freeways carrying heavy flows of truck traffic. This included operational and safety improvements along I-710, I-10, SR-60, I-15, I-5, SR-39, SR-55, SR-57, SR-91, I-405, I-605, I-110, and SR-86. The complete list of projects included in Bundle 1 is presented in Appendix A as well as figures identifying the locations of the projects.
    - Note that the projects included in Bundle 1 are primarily taken from SCAG's 2004 RTP and represent non-truck lane improvements not included under existing committed funding plans. For the purposes of this project, no additional non-truck lane improvements are included in this bundle. Therefore, this bundle is classified as strategic improvements, as they address already identified areas of concern.
2. Dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to SR-60), SR-60 (I-710 to I-15), and I-15 (SR-60 to Victorville).
3. Dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to I-10), I-10 (I-710 to I-15), and I-15 (I-10 to Victorville).
4. Dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to SR-91), SR-91 (I-710 to I-15), and I-15 (SR-91 to Victorville).
5. Dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to I-10), two Westbound truck lanes I-10 (I-710 to I-15), two Eastbound truck lanes SR-60 (I-710 to I-15), two Northbound truck lanes I-15 (SR-60 to I-10), and dedicated truck lanes (2 lanes in each direction) on I-15 (I-10 to Victorville).
6. Dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to SR-91), SR-91 (I-710 to SR-57), SR-57 (SR-91 to SR-60), SR-60 (SR-57 to I-15), and I-15 (SR-60 to Victorville).
7. Dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to SR-91), SR-91 (I-710 to I-605), I-605 (SR-91 to I-10), I-10 (I-605 to I-15), and I-15 (I-10 to Victorville).
8. Dedicated truck lanes (2 lanes in each direction) on I-5 (I-710 to Kern County).
9. Dedicated truck lanes (2 lanes in each direction) on I-5 (U.S./Mexico Border to Kern County).
10. Mixed-flow toll expressways (2 lanes in each direction) for autos and light trucks on I-710 (Ports to SR-60), SR-60 (I-710 to I-15), and I-15 (SR-60 to Victorville).
11. Alternative technologies (e.g., Shuttle Trains, Maglev) to move goods between POLA/POLB and inland destinations.

12. Dedicated truck lanes (2 lanes in each direction) on I-15 (U.S./Mexico Border to Victorville).

The 12 bundles above can be classified as mixed-flow, operational improvement, dedicated truck lane, mixed-flow toll lane, and alternative technology applications. The bundles above will also be used to test the revenue generating potential of truck tolls, as well as the potential for LCV application. The primary purpose of the bundles described above is to answer the following questions, initially raised in the MCGMAP's scope of work:

- To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?
  - This will be answered by comparing the system performance of the bundles that include dedicated truck lanes.
- What portion of dedicated truck lane costs could be offset by user financing, and what additional revenues or funding sources would be needed to support dedicated truck lanes?
  - This will be answered through an evaluation of toll revenue generation potential, described in Chapter 3.
- What policy changes would facilitate or enhance truck lane feasibility? (e.g., LCV's, mandatory use, etc.)?
  - This will be answered through an evaluation of LCV operations, described in Chapter 3.
- Can dedicated truck lanes offer sufficient benefits to be a preferable alternative to other ways of accommodating increased freight traffic (such as adding mixed-flow lanes, adding rail capacity, etc.)?
  - This will be answered by comparing the system performance of the dedicated truck lane bundles to the system performance of the mixed-flow (Bundle 1), alternative technology (Bundle 11), and mixed-flow toll expressway (Bundle 10) bundles.
- What may be the differential effects of the construction of truck lanes on different sub-regions (i.e. the specific types of benefits and impacts that may occur to different sub-regions, depending on facility location)?
  - This will be answered by comparing impacts of truck lane bundles across subregions (defined as segments of each bundle route through the MCGMAP Region).

Application of Travel Demand Model

Given the congestion of the regional transportation network under Year 2030 baseline conditions, it is clear that additional capacity would be beneficial along any route. The application of the travel demand model is consistent with this understanding.

For each of the 12 bundles, network improvements were made to the Year 2030 baseline network (representing projects included under the committed funding plans of MCGMAP project partners, or Scenarios 1, 2, and 3) consistent with the specific bundles. The SCAG travel demand forecasting model was then used to evaluate system performance under each of the bundles. Year 2030 baseline network performance was documented in Tech Memo 4b.

Note that all model runs were completed by SCAG modeling staff consistent with the methodologies applied for all RTP and other regional modeling. This includes an iterative process of running the travel demand model vehicle assignment mode a number of times. Close coordination between project team and SCAG staff occurred and information was exchanged on a daily basis.

As shown on the figures below, the addition of dedicated truck lanes along any combination of regional freeways would result in increased truck volumes along those routes. The truck and vehicle volumes shown in the following figures represent one component of future systems performance under the project bundles. For the purposes of this project, volume data is used as the primary source for comparison of bundles. As the travel demand model allocates vehicle and truck volumes along routes based on available capacity, changes in volumes are indicative of changes in congestion level and therefore operational performance.

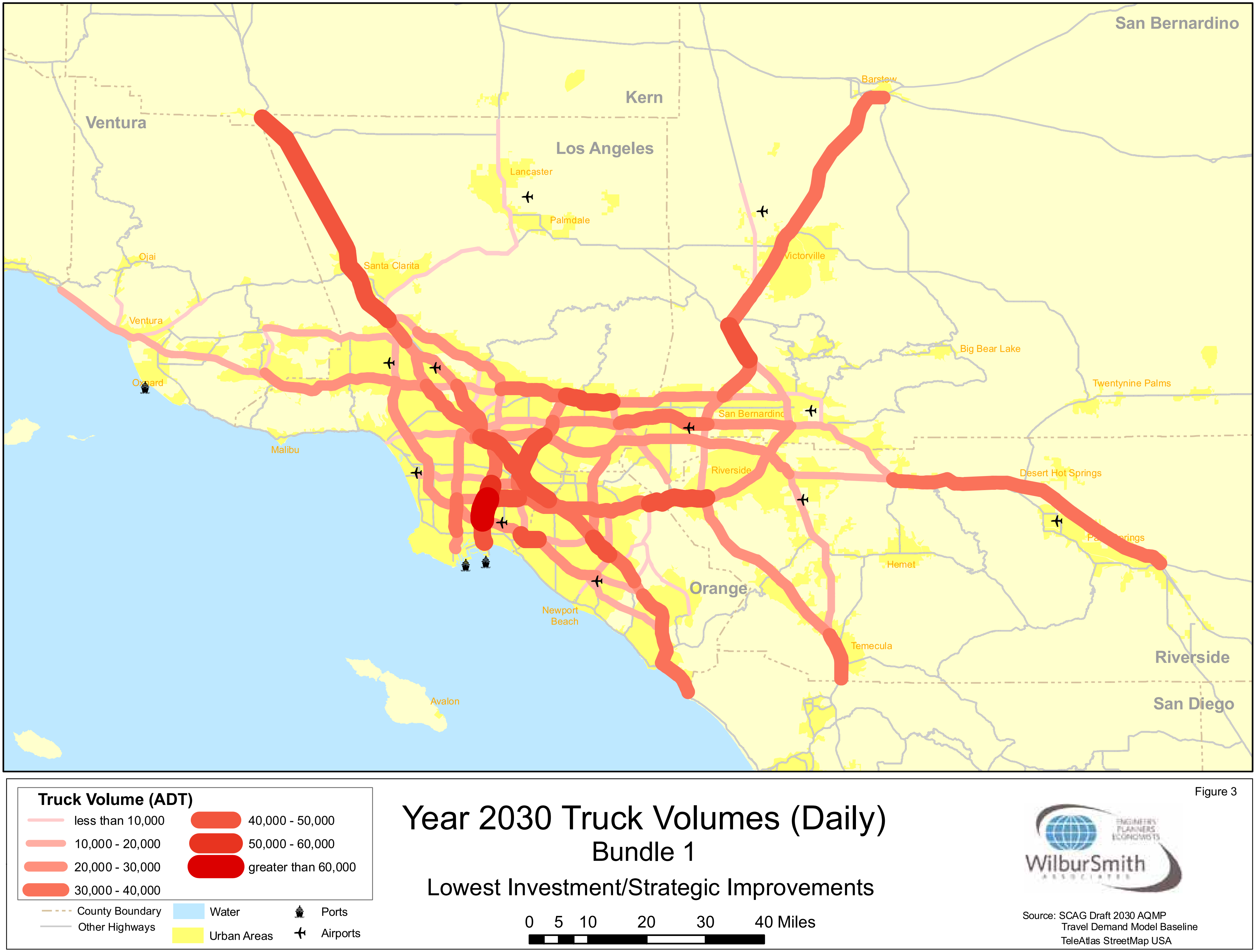


Figure 3

Year 2030 Truck Volumes (Daily)

Bundle 1

Lowest Investment/Strategic Improvements

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

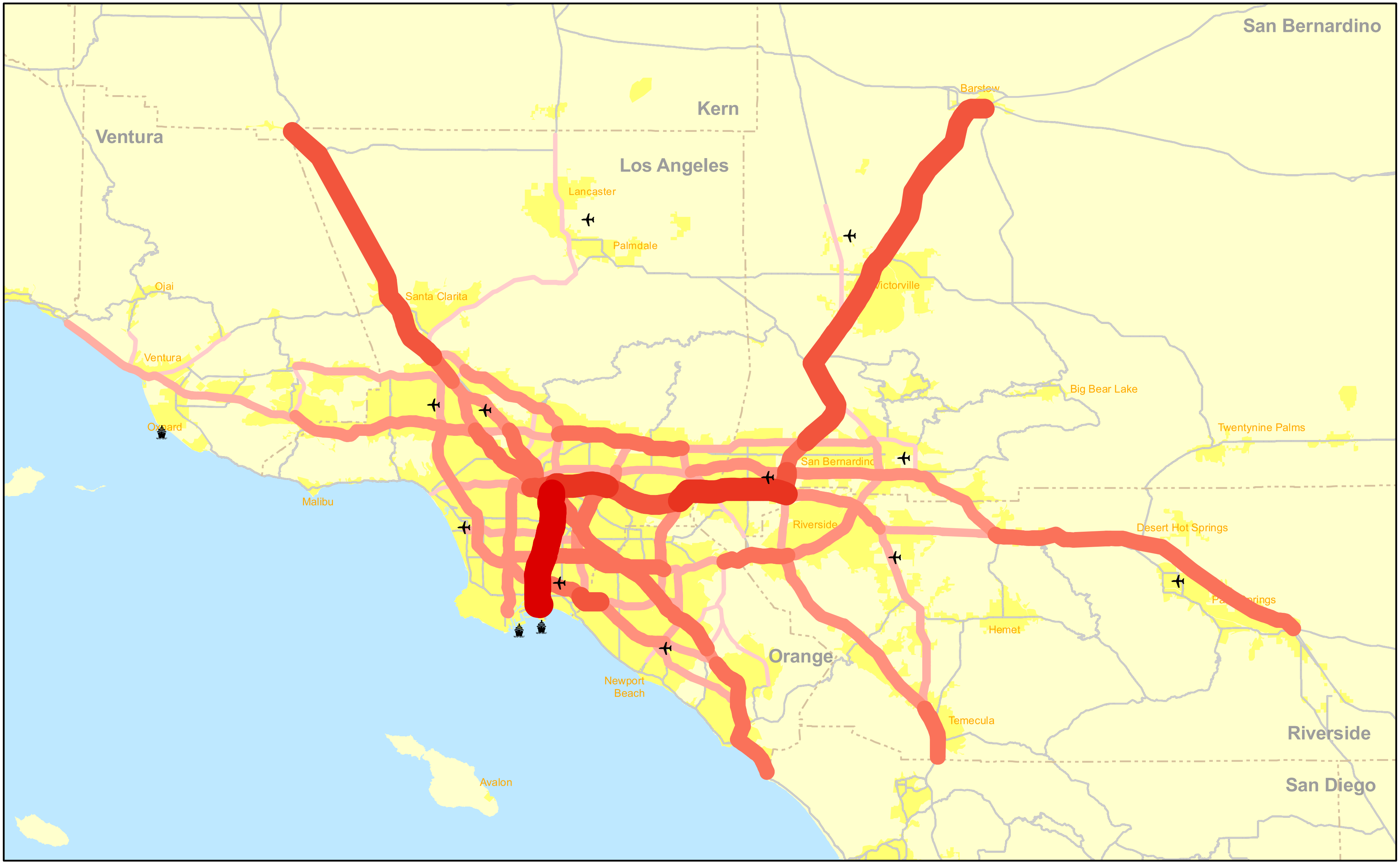


Figure 4

Year 2030 Truck Volumes (Daily)

Bundle 2 Truck Lanes

710 > 60 > 15

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

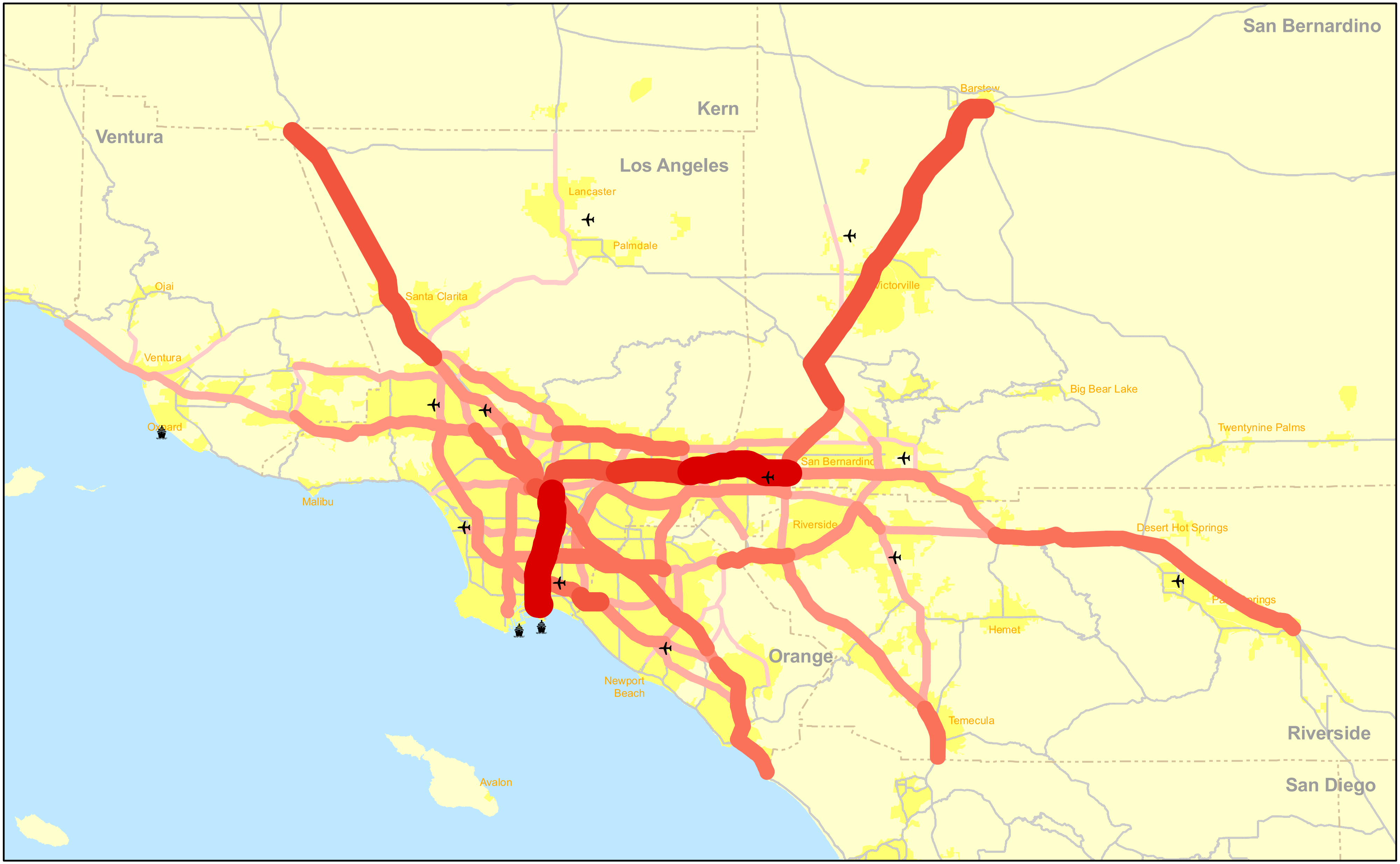


Figure 5

Year 2030 Truck Volumes (Daily)

Bundle 3 Truck Lanes

710 > 10 > 15

0 5 10 20 30 40 Miles

Truck Volume (ADT)

less than 10,000
10,000 - 20,000
20,000 - 30,000
30,000 - 40,000
40,000 - 50,000
50,000 - 60,000
greater than 60,000

County Boundary
Other Highways
Water
Urban Areas
Ports
Airports

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

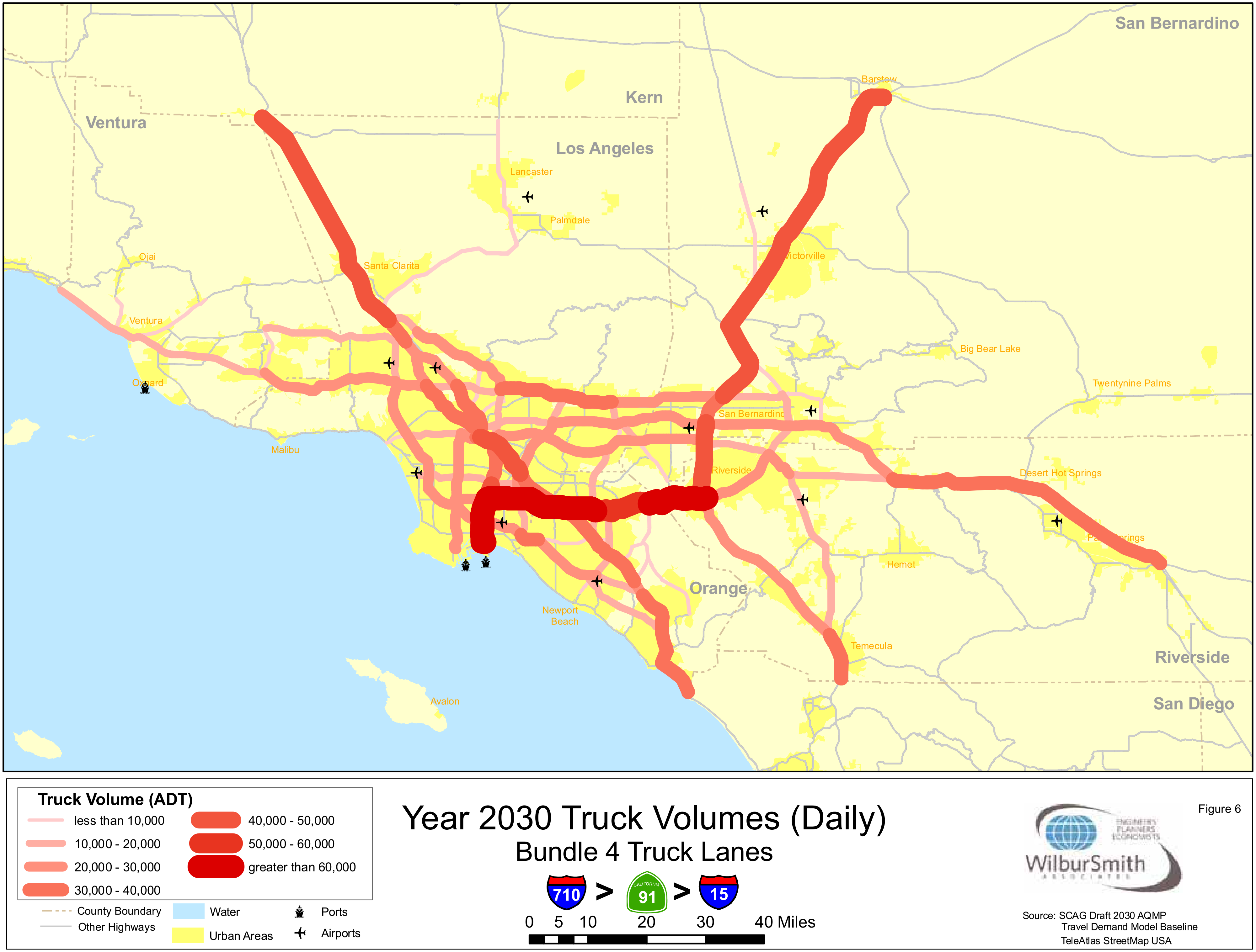
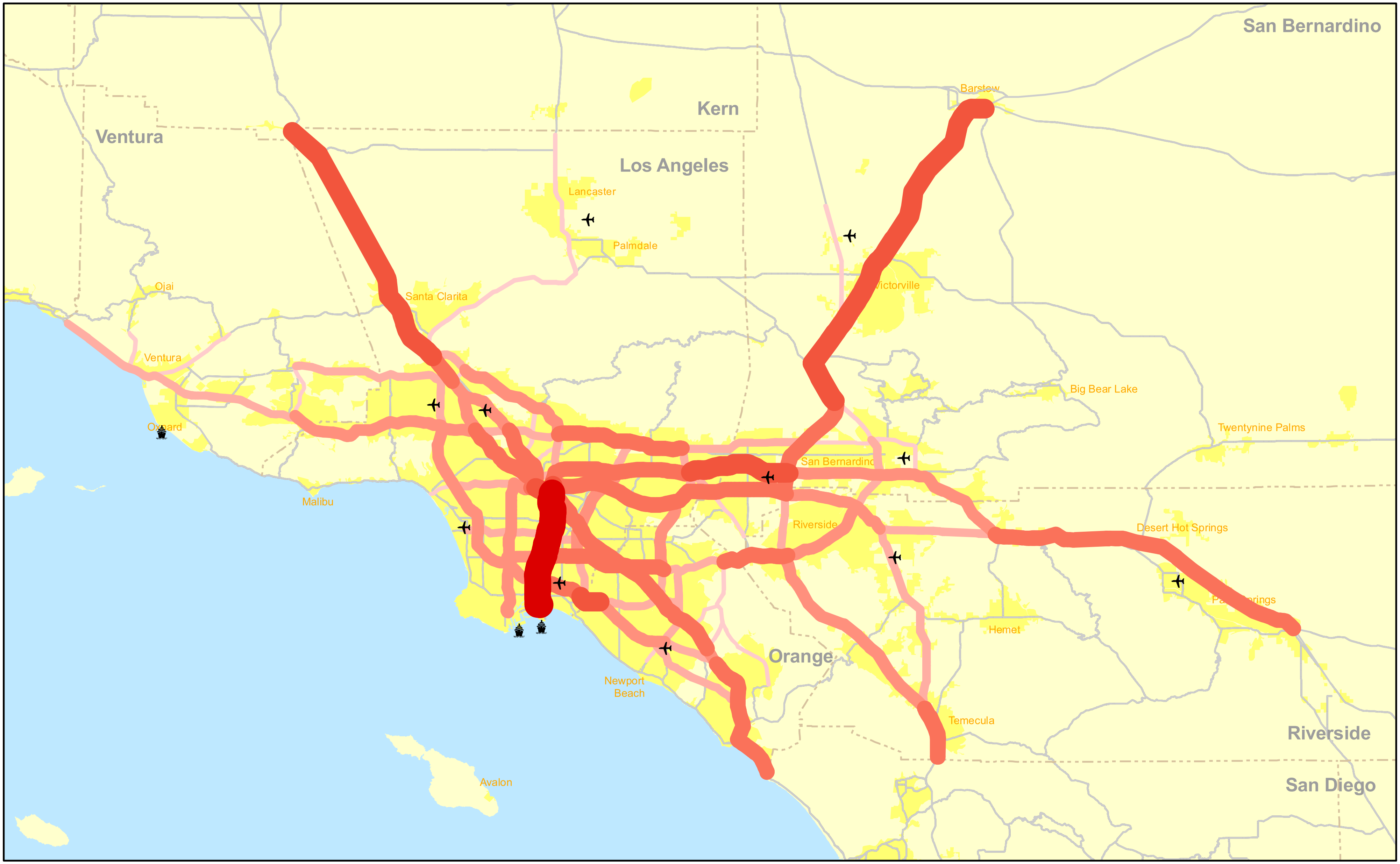


Figure 6

Year 2030 Truck Volumes (Daily)
Bundle 4 Truck Lanes



Truck Volume (ADT)
- less than 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- 30,000 - 40,000
- 40,000 - 50,000
- 50,000 - 60,000
- greater than 60,000
- County Boundary
- Other Highways
- Water
- Urban Areas
- Ports
- Airports

Year 2030 Truck Volumes (Daily)

Bundle 5 Truck Lanes

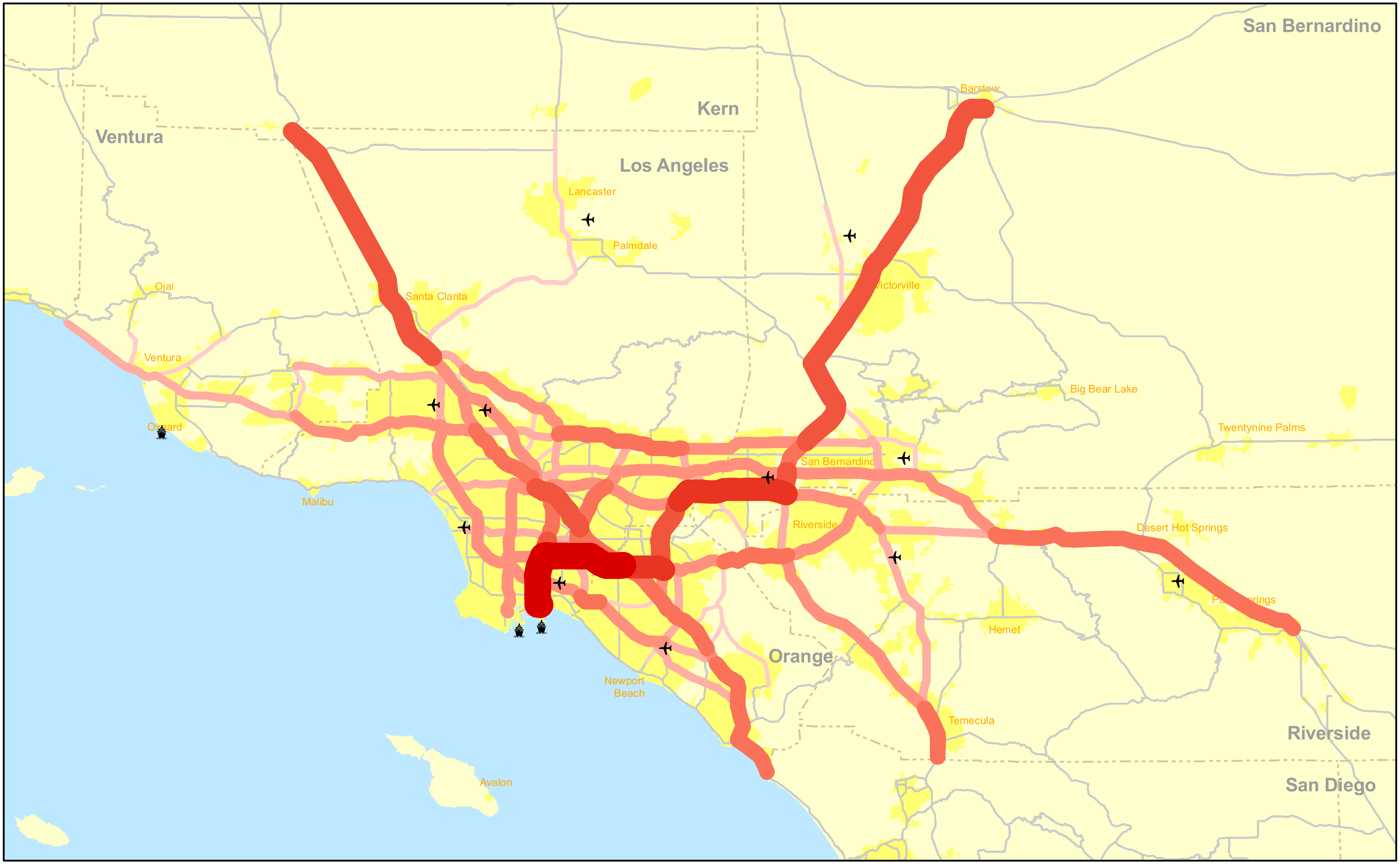
710 > 60 EB > 10 WB > 15

0 5 10 20 30 40 Miles

Figure 7

WilburSmith ASSOCIATES — ENGINEERS PLANNERS ECONOMISTS

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA



Truck Volume (ADT)

- less than 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- 30,000 - 40,000
- 40,000 - 50,000
- 50,000 - 60,000
- greater than 60,000

County Boundary
Other Highways
Water
Urban Areas
Ports
Airports

Year 2030 Truck Volumes (Daily)

Bundle 6 Truck Lanes

710 > 91 > 57 > 60 > 15

0 5 10 20 30 40 Miles

Figure 8

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

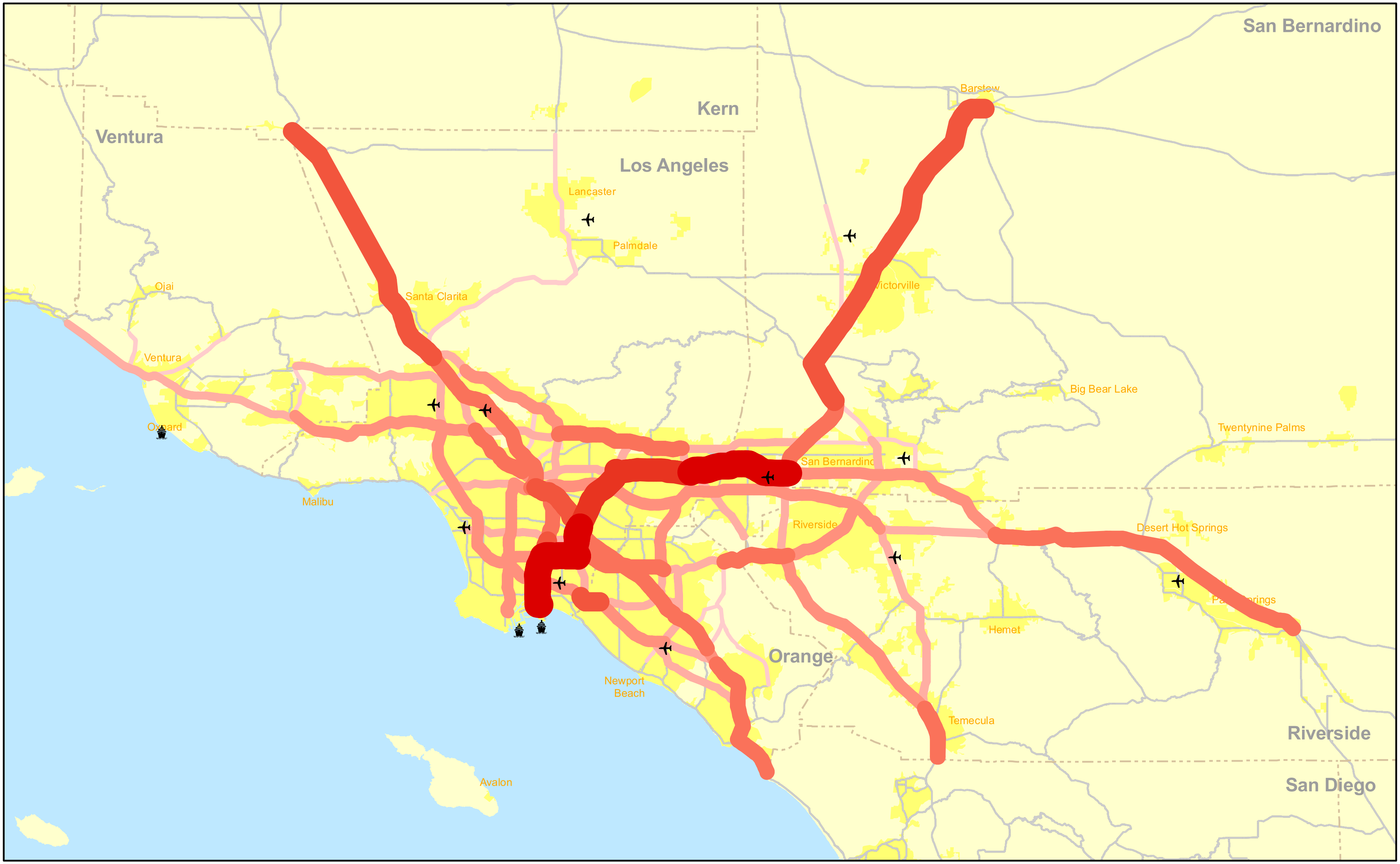


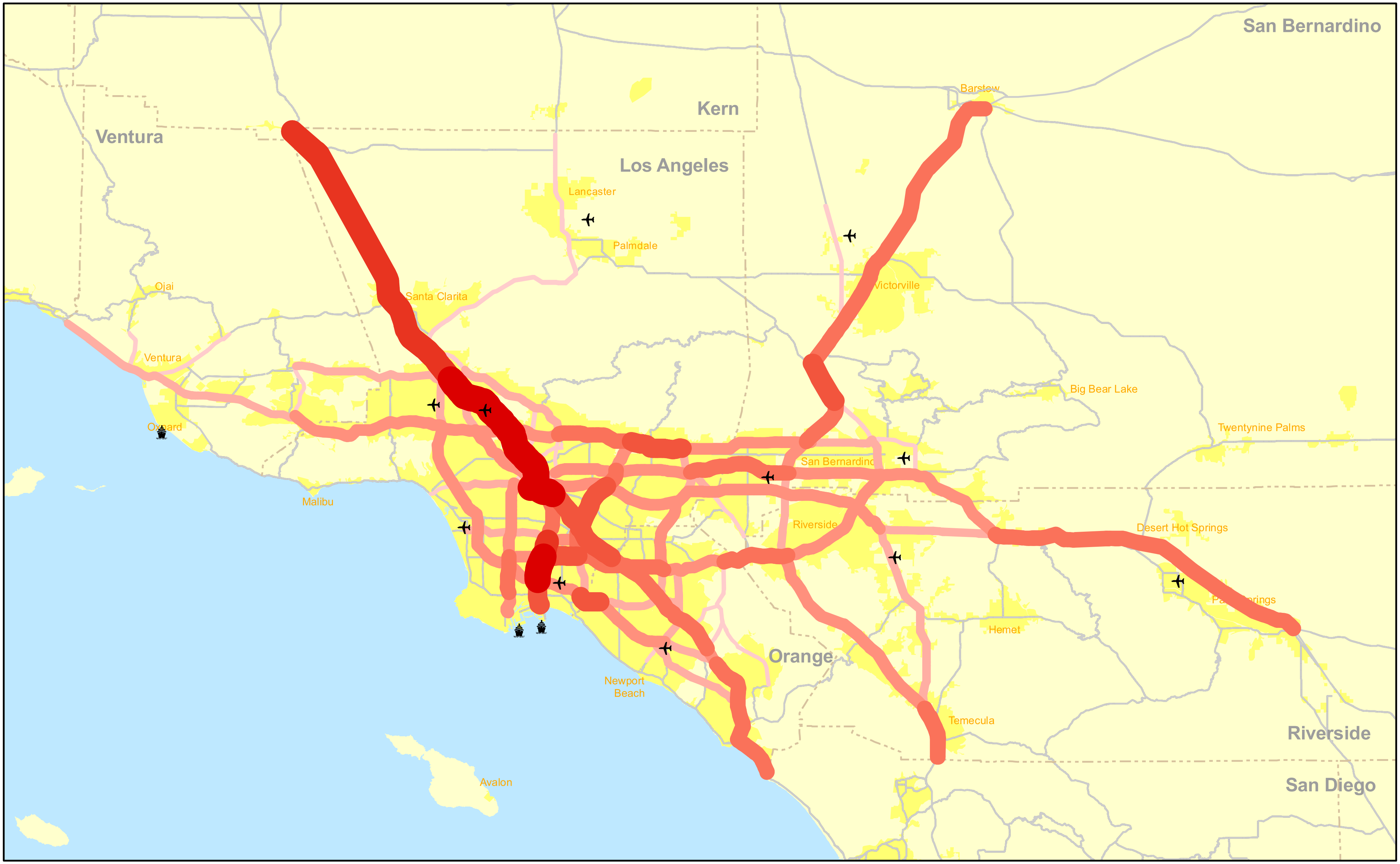
Figure 9

Year 2030 Truck Volumes (Daily)

Bundle 7 Truck Lanes

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

Figure 10



Truck Volume (ADT)

- less than 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- 30,000 - 40,000
- 40,000 - 50,000
- 50,000 - 60,000
- greater than 60,000

County Boundary | Other Highways | Water | Urban Areas | Ports | Airports

Year 2030 Truck Volumes (Daily)

Bundle 8 Truck Lanes

5 I-710 to Kern County

0 5 10 20 30 40 Miles

WilburSmith ASSOCIATES — ENGINEERS PLANNERS ECONOMISTS

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

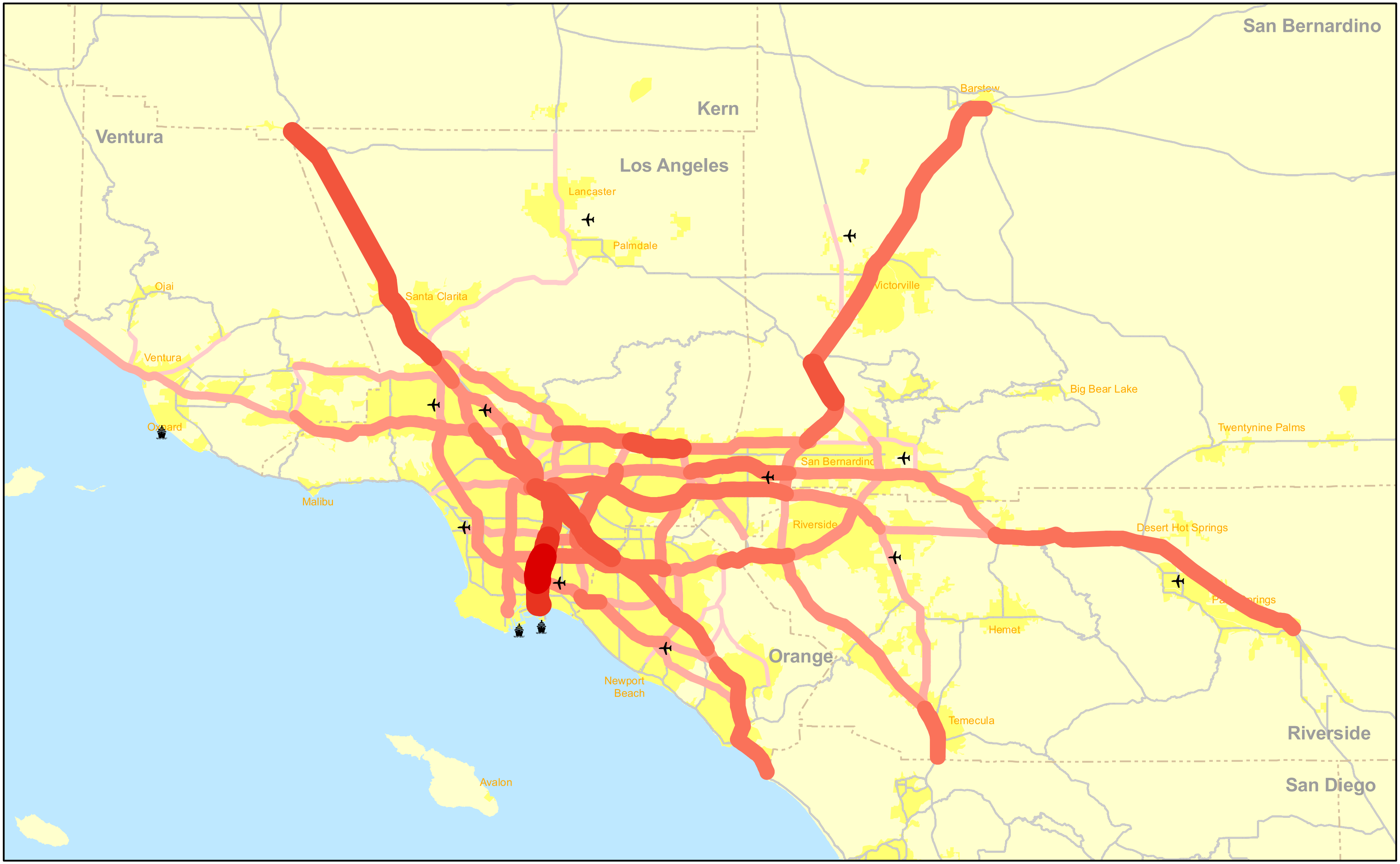
Year 2030 Truck Volumes (Daily)

Bundle 9 Truck Lanes

5 Mexico to Kern County

Figure 11

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA



Truck Volume (ADT)

- less than 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- 30,000 - 40,000
- 40,000 - 50,000
- 50,000 - 60,000
- greater than 60,000

County Boundary
Other Highways
Water
Urban Areas
Ports
Airports

Year 2030 Truck Volumes (Daily)

Bundle 10 Mixed Flow Toll

710 > 60 > 15

0 5 10 20 30 40 Miles

Figure 12

WilburSmith Associates

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

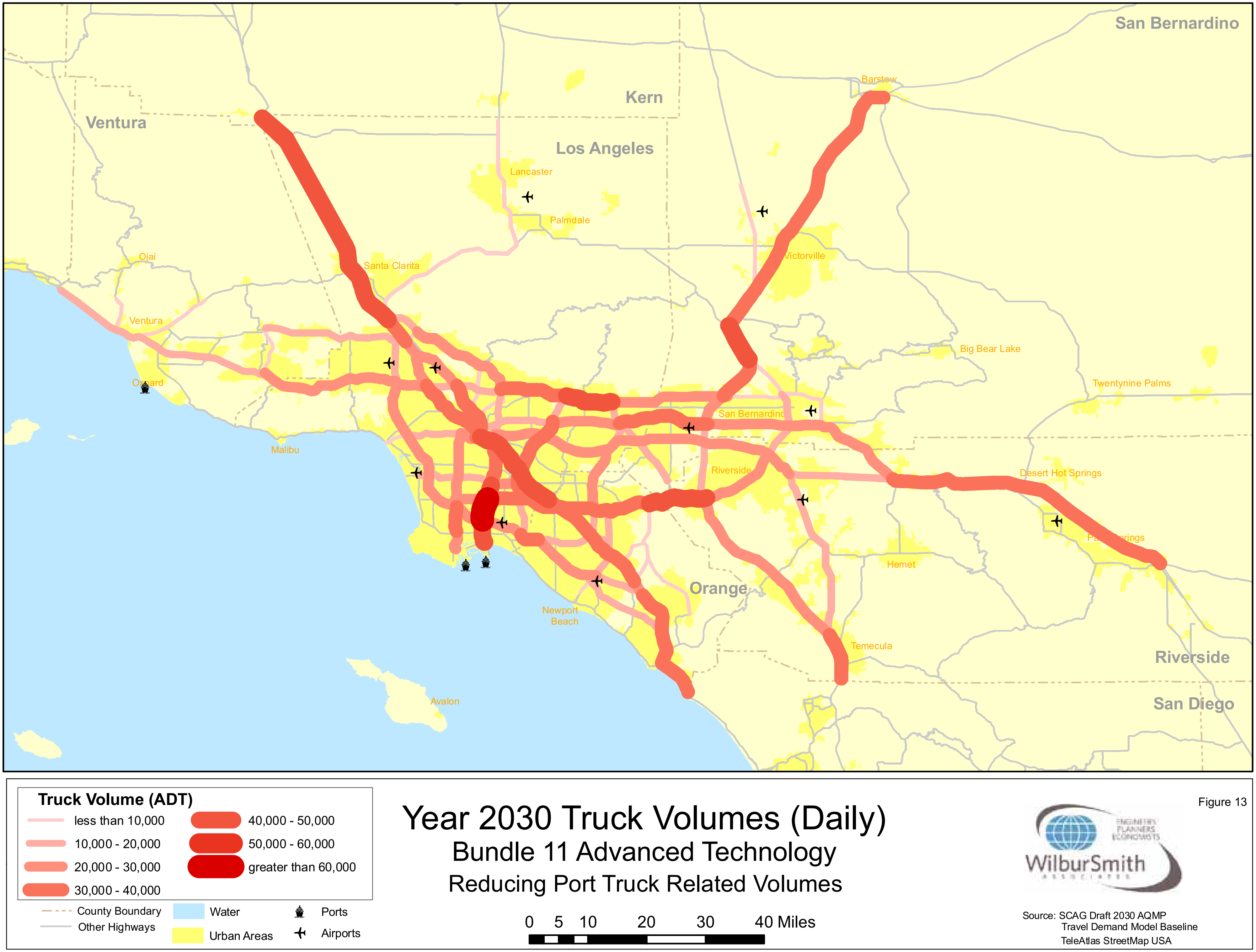


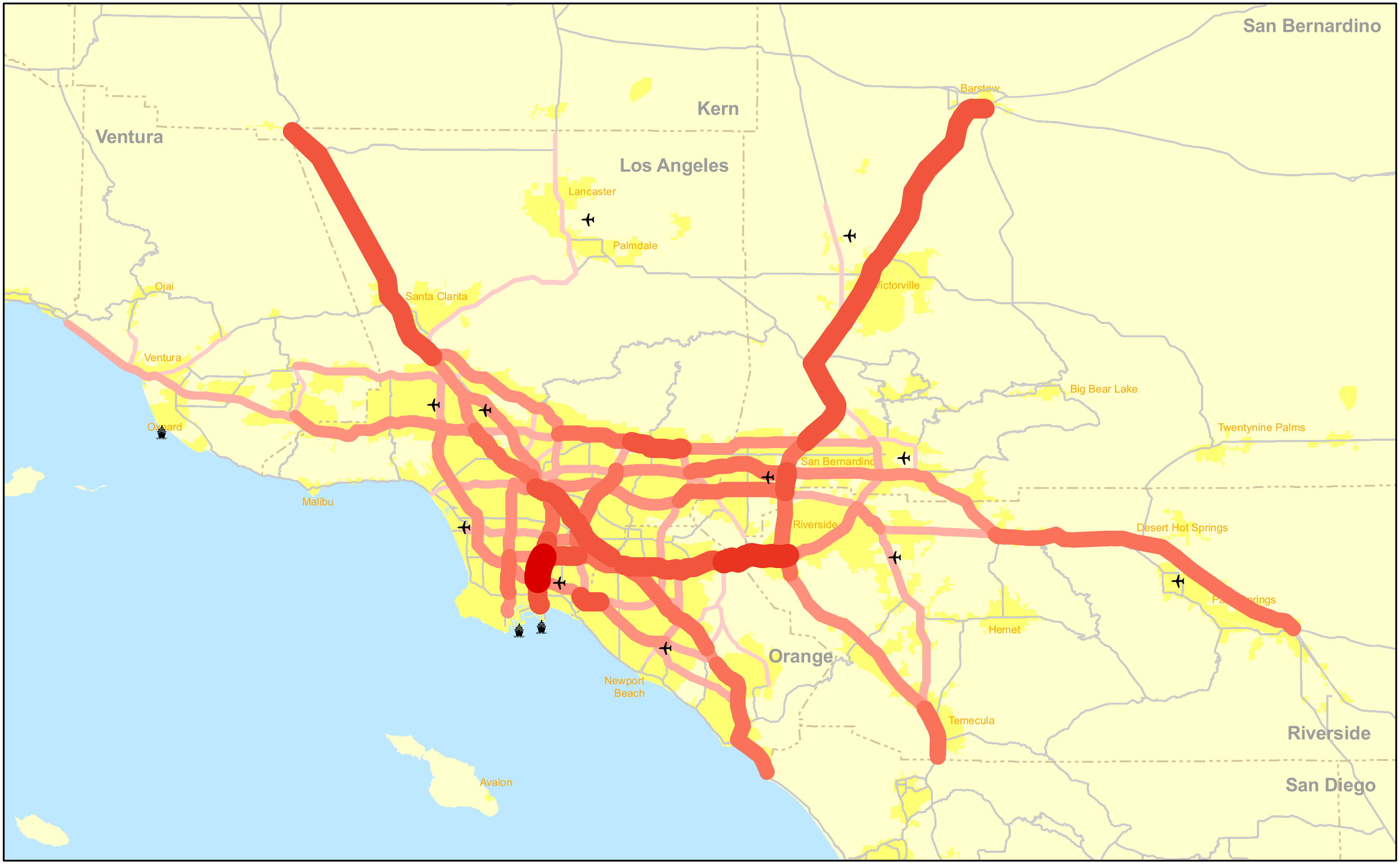
Figure 13

Year 2030 Truck Volumes (Daily)

Bundle 11 Advanced Technology

Reducing Port Truck Related Volumes

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA



Year 2030 Truck Volumes (Daily)

Bundle 12 Truck Lanes

15 Mexico to Victorville

Truck Volume (ADT)

- less than 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- 30,000 - 40,000
- 40,000 - 50,000
- 50,000 - 60,000
- greater than 60,000

County Boundary
Other Highways
Water
Urban Areas
Ports
Airports

0 5 10 20 30 40 Miles

Figure 14

Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

Impact of Truck Lanes on Different Sub-Regions

The first question that the application of the travel demand model answers is: What may be the differential effects of the construction and use of truck lanes on different sub-regions (i.e. the specific types of benefits and impacts that may occur to different sub-regions, depending on facility location within a broad region/corridor)? For the purposes of this analysis, subregions are defined as directional segments of the bundle routes. In general, the subregions used for comparison are:

- The north-south connection between the San Pedro Bay Ports and downtown Los Angeles.
- The east-west connection between I-710 and I-15.
- The north-south connection from downtown Los Angeles to Kern County.
- The north-south connection from San Diego County to downtown Los Angeles.
- The north-south connection from SR-91 to Victorville (along the I-15 corridor).

Bundles 2, 3, 4, 5, 6, 7, 8, 9, and 12 evaluate truck lane systems along various regional highways. Average daily volumes in one direction for both vehicles (autos) and trucks are shown on Table 1 below. Also shown on the table is the average daily vehicle and truck volumes along the entire route. Note that the average vehicle and truck volumes represent both a single (spot) location along the entire route length as well as an average of both directions along the entire route length; actual volumes may be higher or lower along various segments of the route.

Table 1
Average Daily Volumes by Bundle - Year 2030

Bundle	Description	Distance (Miles)	Avg. Veh. (ADT, One Direction, Spot Location)	Avg. Trucks (ADT, One Direction, Spot Location)	Sum of Avg. Veh. & Trucks	Entire Route	
						Vehicles (Daily, Both Directions, by Segment)	Trucks (Daily, Both Directions, by Segment)
2	I-710 to SR-60 to I-15	101.5	63,248	11,872	75,121	267,627	54,563
3	I-710 to I-10 to I-15	98.7	59,740	11,195	70,935	263,168	55,506
4	I-710 to SR-91 to I-15	87.5	61,329	10,542	71,871	271,455	56,745
5	I-710 to I-10 (WB) / SR-60 (EB) to I-15	100.1	68,080	10,328	78,407	262,397	47,248
6	I-710 to SR-91 to SR-57 to SR-60 to I-15	110.0	57,447	9,688	67,135	252,006	49,729
7	I-710 to SR-91 to I-605 to I-10 to I-15	96.1	57,935	10,328	68,264	271,079	56,415
8	I-5 (I-710 to Kern	74.6	77,752	12,328	90,080	374,735	62,541

Table 1
Average Daily Volumes by Bundle - Year 2030

Bundle	Description	Distance (Miles)	Avg. Veh. (ADT, One Direction, Spot Location)	Avg. Trucks (ADT, One Direction, Spot Location)	Sum of Avg. Veh. & Trucks	Entire Route	
						Vehicles (Daily, Both Directions, by Segment)	Trucks (Daily, Both Directions, by Segment)
	County)						
9	I-5 (U.S./Mexico Border to Kern County)	204.6	77,425	10,679	88,104	376,202	56,099
12	I-15 (U.S./Mexico Border to Victorville)	161.7	52,918	8,594	61,512	221,443	37,921

The following conclusions can be drawn from the table above:

- The **highest truck and vehicle volumes** would be carried by a truck lane system on I-5 extending from I-710 (near downtown Los Angeles) to the Kern County line.
  - This reflects the large number of trucks to/from the Central Valley of California destined for the intermodal yards near downtown Los Angeles, as shown on Figure 15.
  - This also shows that I-5 carries the highest vehicle volumes of the freeways evaluated under the specific bundles.
- For the routes extending from the San Pedro Bay Ports to Victorville, the **highest truck volumes** would be carried by a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15; a truck lane system that includes I-10 as an east-west connection between I-710 and I-15 would carry nearly as much truck traffic.
- For the routes extending from the San Pedro Bay Ports to Victorville, the **highest vehicle volumes** would be carried by a truck lane system that includes both SR-60 and I-10 as an east-west connection between I-710 and I-15
  - For the routes extending from the San Pedro Bay Ports to Victorville, the **highest truck and vehicle volumes** would be carried by a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15; a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15 would carry nearly as much truck and vehicle traffic.

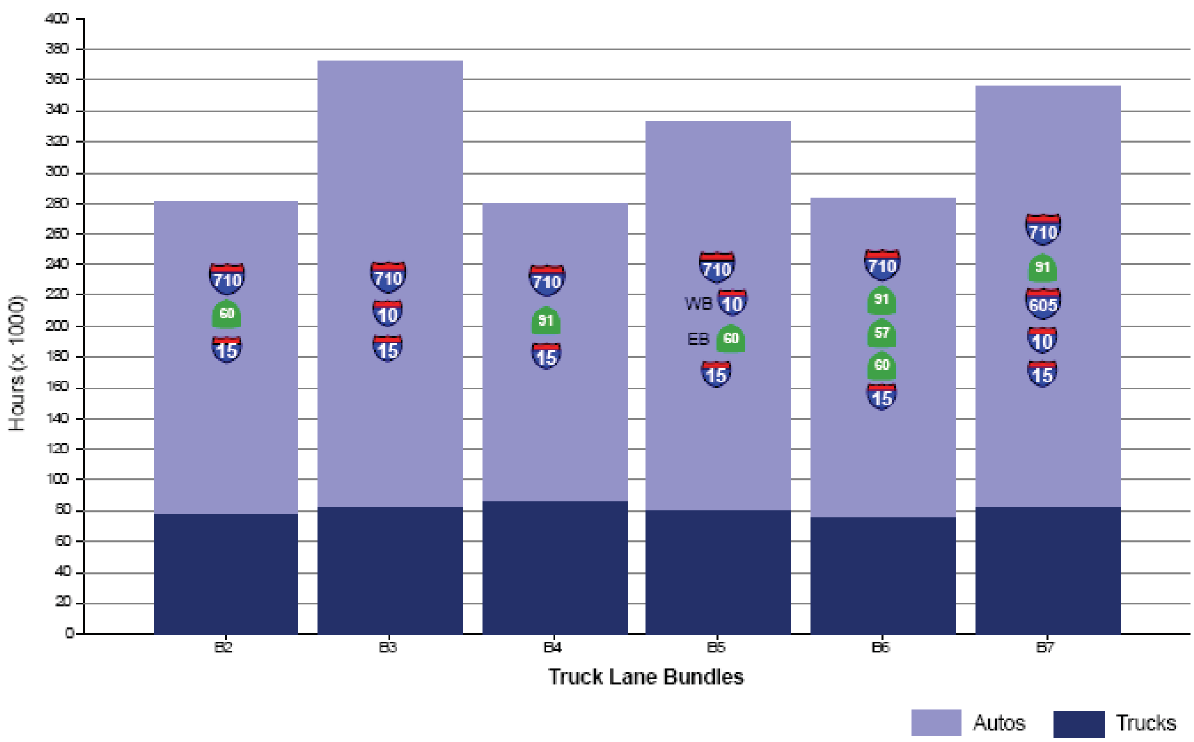
Figure 15


San Bernardino
Kern
Ventura
Los Angeles
Lancaster
Palmdale
Santa Clarita
Ojai
Ventura
Oxnard
Malibu
Barstow
Victorville
Big Bear Lake
Twentynine Palms
Desert Hot Springs
Riverside
Orange
Hemet
Temecula
Newport Beach
Avalon
Riverside
San Diego
Truck Volume
0 - 1000
1000 - 5000
5000 - 10000
10000 - 20000
greater than 20000
02/19/07
Water
Urban Areas
County Boundary
Other Highways
Ports
Airports
Year 2030 Heavy Truck Volume
External (Outside the Region) Origin/Destination
0 5 10 20 30 40 Miles
WilburSmith ASSOCIATES
ENGINEERS PLANNERS ECONOMISTS
Source: SCAG Draft 2030 AQMP
Travel Demand Model Baseline
TeleAtlas StreetMap USA

Bundles 8, 9, and 12 represent truck lane systems that are independent in utility and routing and hence represent different overall corridors and regions. Therefore, the differential effects of the construction and use of truck lanes on different sub-regions (within a broad corridor and region) can be summarized based on further analysis of data for bundles 2, 3, 4, 5, 6, and 7 which represent alternatives for the broad corridor connecting the San Pedro Bay ports and the region around Victorville.

One measure is the reduction in overall congestion on regional freeways. The figure below shows the comparison of the reduction in delay for the bundles from the SPB Ports to Victorville (2, 3, 4, 5, 6, and 7). Since this is part of a regional evaluation seeking to improve mobility for all modes, the figure shows the reduction in hours of delay for both vehicles and trucks. Figure 16 is based on daily traffic volumes and incorporates congested travel time data from peak and off-peak periods. The figure below highlights the reduction in daily hours of delay over Year 2030 Baseline conditions, which are forecast to be 8,757,000 hours for vehicles (autos) and 737,000 hours for trucks.

Figure 16
Reduction in Hours of Delay for Vehicles and Trucks
(Year 2030 Baseline vs. Bundles containing Truck Lanes from the SPB Ports to Victorville)



The following conclusions can be drawn from Figure 16 above:

- For **trucks**, the difference in reduction of hours of delay is relatively consistent between bundles and **no bundle clearly offers greater improvement when compared to others**.
    - There is slightly greater reduction in hours of truck delay for a truck lane system that includes SR-91 as an east-west connection between I-710 and I-15; most likely due to the reduced overall distance of truck lane systems utilizing SR-91 (since it would represent a more direct route between the San Pedro Bay Ports and Victorville, therefore more trucks may utilize this route when analyzed with a travel demand model, resulting in a greater reduction in overall delay).
- For **vehicles (autos)**, the difference in reduction of hours of delay is much greater for those truck lane systems that include I-10.
    - This reflects the highly congested conditions (both existing and forecast future) along I-10 and the high volume of both truck and vehicle volumes.

Are Truck Lanes a Viable Alternative?

The second question that the application of the travel demand model answers is: Can dedicated truck lanes offer sufficient benefits to be a preferable alternative to other ways of accommodating increased freight traffic (such as adding mixed-flow lanes, adding rail capacity, advanced technologies, etc.)?

Additionally, the application of the travel demand model can answer the following question: To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?

Bundle 1 includes operational and safety improvements (including mixed-flow lanes) along the regional highway system. For the purposes of this study, the volumes of the first three bundles were compared, along the Bundle 2 network (a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15). The first three bundles were chosen for comparison because they represent the baseline conditions, the operational and safety improvement conditions, and the first of the dedicated truck lane system alternatives. The results are shown on the figure below and on Table 2 that follows.

Figure 17
Comparison of Year 2030 Truck and Vehicle Volumes along the Bundle 2 Network (Compares Baseline Volumes with the Operational and the Truck Lane Improvements from the SPB Ports to Victorville)

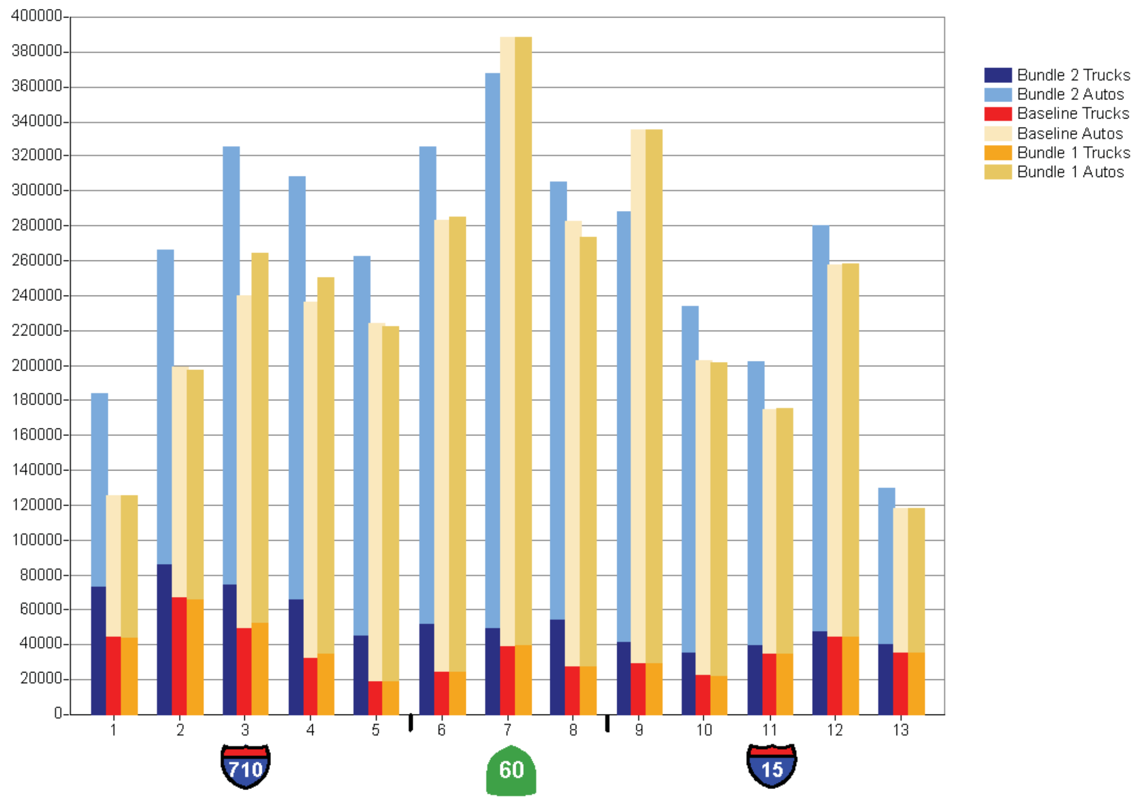


Table 2
Summary of Year 2030 Truck and Vehicle Volumes along Bundle 2 Network

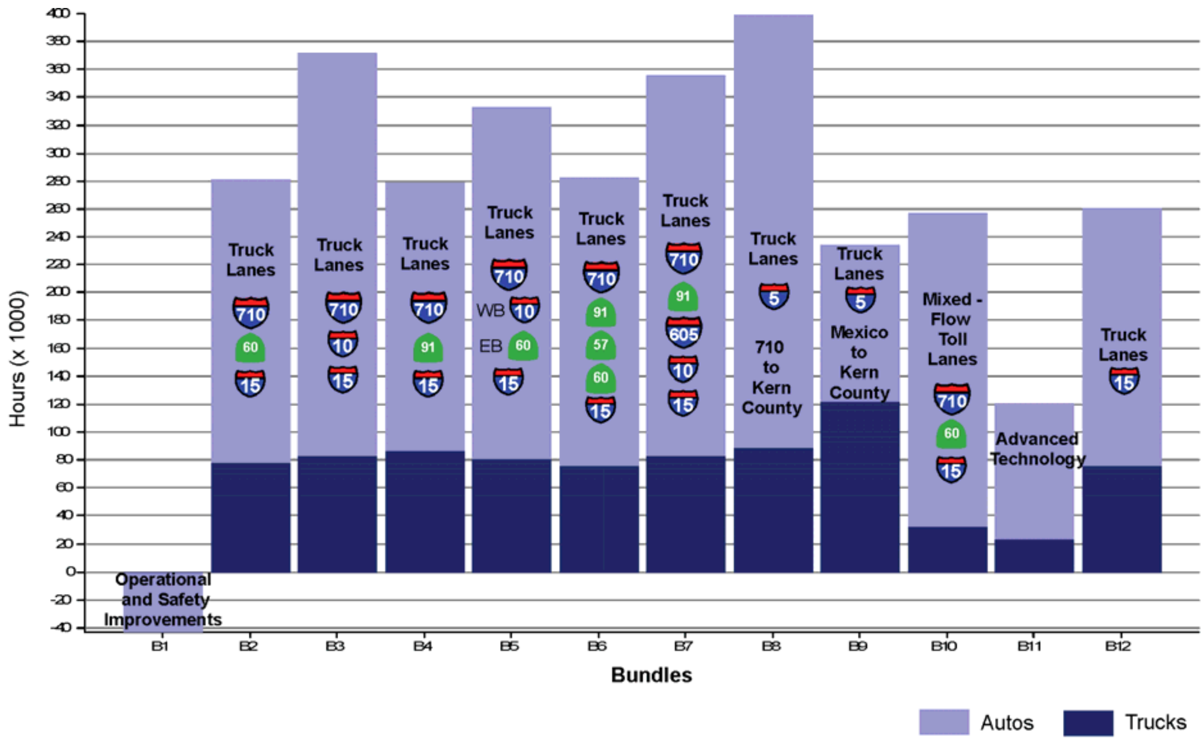
Route	Segment	Vehicles (Daily, Both Directions, by Segment)			Trucks (Daily, Both Directions, by Segment)		
		Baseline	Bundle 1	Bundle 2	Baseline	Bundle 1	Bundle 2
I-710	END to I-405	125,606	125,377	183,971	44,716	44,501	73,643
I-710	I-405 to SR- 91	198,345	197,766	266,348	67,177	66,767	86,496
I-710	SR-91 to I-105	243,111	264,310	325,109	49,601	52,767	74,787
I-710	I-105 to I-5	239,787	250,344	308,473	32,552	35,647	66,359
I-710	I-5 to SR-60	223,555	222,314	262,415	19,590	19,523	45,417
SR-60	I-710 to I-605	283,895	284,845	325,351	25,212	25,267	51,668
SR-60	I-605 to SR-57	275,634	388,350	367,638	25,901	40,075	49,696
SR-60	SR-57 to I-15	282,737	273,511	305,220	27,671	27,518	54,545
I-15	SR-60 to I-10	226,077	334,922	288,399	19,817	29,625	41,593
I-15	I-10 to I-210	203,101	201,657	233,953	22,583	22,395	36,276
I-15	I-210 to I-215	174,401	175,230	202,266	35,681	35,610	40,103
I-15	I-215 to SR-138	258,082	258,891	280,359	45,249	45,147	48,108
I-15	SR-138 to I-40	118,073	118,092	129,651	36,212	36,261	40,622

The following conclusions can be drawn from Figure 16 and Table 2 above:

- For **trucks**, operational and safety improvements (including mixed-flow lanes, as represented by Bundle 1) would not affect forecast volumes along the identified segments.
  - Therefore it can be stated that operational and safety improvements (including mixed-flow lanes) would not affect a change in truck travel patterns or volumes, as compare to the addition of truck lanes which are a successful approach for attracting trucks from other facilities.
- For **vehicles (autos)**, operational and safety improvements (including mixed-flow lanes, as represented by Bundle 1) would have the greatest effect on forecast volumes along I-710 between the western terminus and SR-91; with virtually no change to vehicle volumes along other identified segments.
  - This reflects the forecast high volume of trucks along I-710 and the associated benefit of adding additional capacity for vehicles (in this case, through interchange improvements); however, overall it shows that operational and safety improvements (including mixed-flow lanes) tend to accommodate demand rather than induce increased volumes.

The figure below shows the comparison of the reduction in delay for all evaluated project bundles. Since this is part of a regional evaluation seeking to improve mobility for all modes, the figure shows the reduction in hours of delay for both vehicles and trucks. Figure 18 is based on daily traffic volumes and incorporates congested travel time data from peak and off-peak periods.

Figure 18
Reduction in Hours of Delay for Vehicles and Trucks
(Year 2030 Baseline vs. All Bundles)



The following conclusions can be drawn from Figure 18 above:

- For **trucks**, the difference in reduction of hours of delay varies greatly, dependant on configuration (e.g., with truck lanes, with mixed-flow toll lanes) and route (e.g., I-5, I-15, or Port-to-Victorville).
  - The most reduction in hours of delay for trucks would occur when dedicated truck lanes are constructed along I-5 from the US/Mexico Border to the Kern County border, due to the improved truck operations that result from adding truck lanes to the limited capacity and highly congested segments along I-5 from the Orange County line to downtown Los Angeles.
  - There is a slight reduction in hours of delay for trucks when mixed-flow toll facilities or alternative technologies (e.g., maglev or shuttle trains) are implemented, due to the fact that the vehicle demand on the region's highways greatly exceeds capacity.
  - With only the construction of the operational and safety improvements (Bundle 1), truck hours of delay would slightly increase, due to the fact that the operational and safety improvements are not adding substantial amounts of new capacity to the highly congested system, and any additional capacity is quickly filled by excessive demand.

- For **vehicles (autos)**, all projects and strategies involving separate dedicated facilities result in reduced hours of delay.
    - The most reduction in hours of delay for vehicles would occur when dedicated truck lanes are constructed from downtown Los Angeles to the Kern County border, due to the high volume of vehicles utilizing this route and the reduced delay due to the separation of trucks onto dedicated facilities.
    - With only the construction of the operational and safety improvements (Bundle 1), vehicle hours of delay would increase, due to the fact that the operational and safety improvements are not adding substantial amounts of new capacity to the highly congested system, and any additional capacity is quickly filled by excessive demand.

In an effort to evaluate the impact of the development of an advanced technology corridor, using an innovative technology such as Maglev, Freight Shuttle or a shuttle train service, a likely scenario was developed. The deployment of such a technology would require a fixed guideway linking staging areas at the SPB port terminals and an inland staging area, the latter functioning much like a conventional rail intermodal yard. Under this evaluation, goods would be transported between the ports and the inland staging yard generally located at the intersection of I-10 and I-15 in the Inland Empire region. An advanced technology mode would be used to transport the goods along a fixed guideway, as opposed to a separated truck lane corridor. An operational target of 1.35 million annual container lifts was set as a reasonable first order of development, and compares with the volumes currently experienced at the Hobart rail intermodal facility, the largest currently operated by a railroad in the study area. The Hobart facility is a good proxy for an operational target as it represents how an inland facility would function in serving a proposed alternative high technology corridor. The operational target represents approximately 5,400 trucks per day, which would in effect be removed from the highways currently linking the ports and the Inland Empire region. To test the benefits of such a corridor, an equivalent amount of trucks were removed from two origin/destination zones in the travel demand model, one representing the ports and the other representing the inland staging yard. The model was then run to determine potential changes to vehicle and truck volumes. The results of the model analysis are shown below.

Figure 19
Comparison of Year 2030 Truck and Vehicle Volumes along the Bundle 2 Network (Compares Baseline Volumes with the Operational and the Advanced Technology Improvements from the SPB Ports to Victorville)

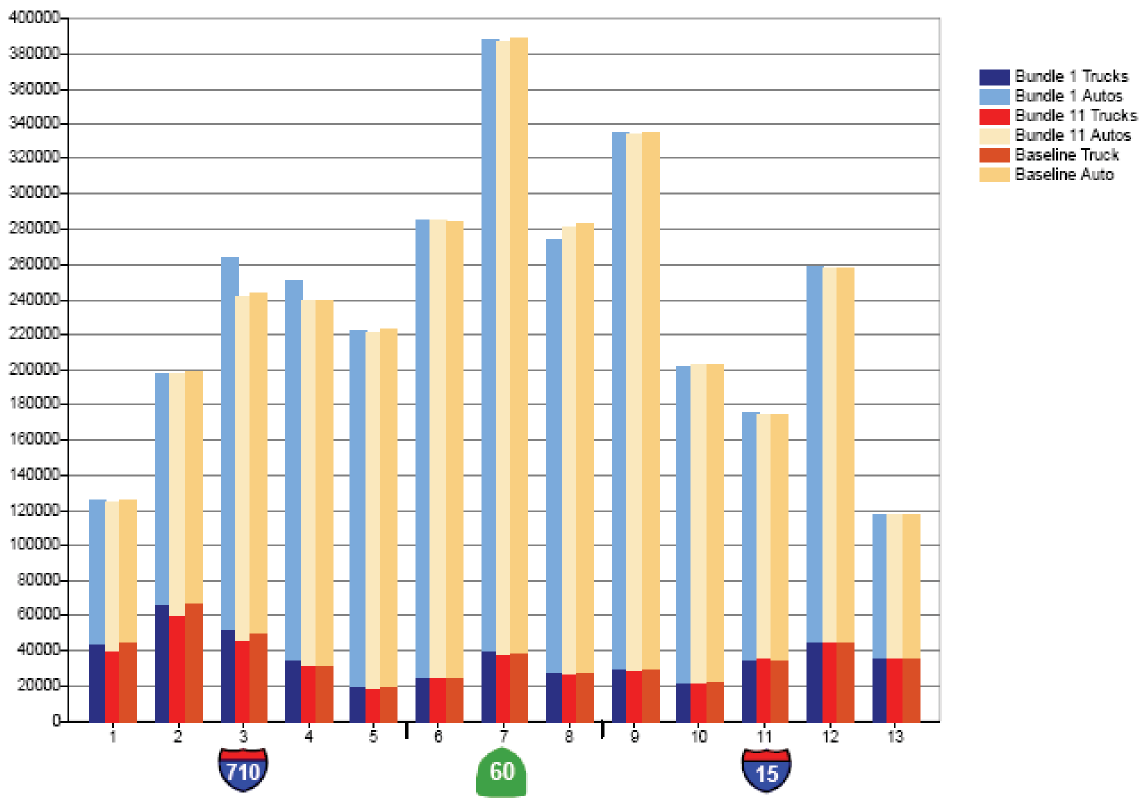
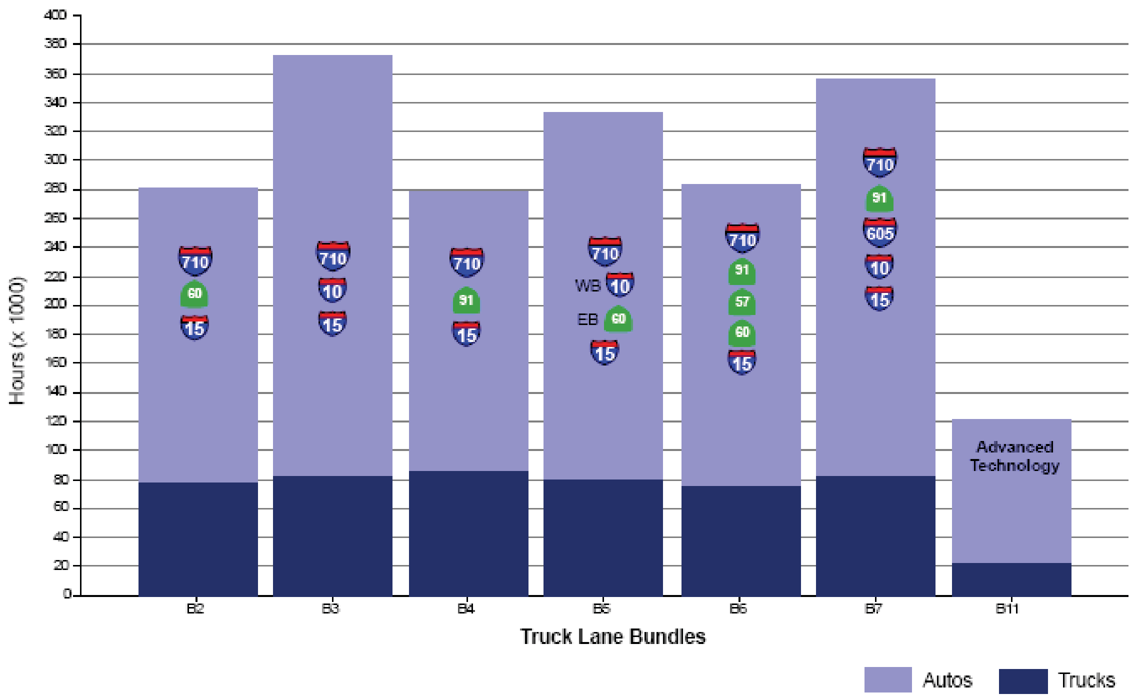


Table 3
Summary of Year 2030 Truck and Vehicle Volumes along Bundle 2 Network (Compares Baseline Volumes with the Operational and the Advanced Technology Improvements from the SPB Ports to Victorville)

Route	Segment	Vehicles (Daily, Both Directions, by Segment)			Trucks (Daily, Both Directions, by Segment)		
		Baseline	Bundle 1	Bundle 11	Baseline	Bundle 1	Bundle 11
I-710	END to I-405	125,606	125,377	124,429	44,716	44,501	40,135
I-710	I-405 to SR- 91	198,345	197,766	197,671	67,177	66,767	60,732
I-710	SR-91 to I-105	243,111	264,310	241,190	49,601	52,767	46,537
I-710	I-105 to I-5	239,787	250,344	239,346	32,552	35,647	32,274
I-710	I-5 to SR-60	223,555	222,314	221,162	19,590	19,523	18,650
SR-60	I-710 to I-605	283,895	284,845	285,108	25,212	25,267	24,676
SR-60	I-605 to SR-57	275,634	388,350	387,006	25,901	40,075	37,890
SR-60	SR-57 to I-15	282,737	273,511	280,667	27,671	27,518	27,012
I-15	SR-60 to I-10	226,077	334,922	333,129	19,817	29,625	29,368
I-15	I-10 to I-210	203,101	201,657	202,161	22,583	22,395	22,492
I-15	I-210 to I-215	174,401	175,230	174,369	35,681	35,610	35,782
I-15	I-215 to SR-138	258,082	258,891	257,722	45,249	45,147	45,193
I-15	SR-138 to I-40	118,073	118,092	118,107	36,212	36,261	36,235

Figure 20
Reduction in Hours of Delay for Vehicles and Trucks
(Year 2030 Baseline vs. Bundles containing Truck Lanes and Advanced Technology Corridor Alternative from the SPB Ports to Victorville)



The following conclusions can be drawn from Figures 18, 19, and 20 and Table 3:

- The truck lane bundles produce substantially larger benefits than the advanced technology bundle, both in terms of the ability to reduce delays for trucks and cars and in terms of shifting trucks away from other highway facilities to the dedicated facility.
  - From a **volume** standpoint, the **truck lane bundles carry a substantially larger truck volume** than the advanced technology bundle, and therefore are able to **have greater system-wide impact**.
  - From a **delay** standpoint, the advanced technology bundle provides the greatest delay benefits on the highways closest to the ports, specifically the segments of I-710 from the ports to the intersection with I-105. **From a regional standpoint, the reduction in hours of delay resulting from the alternative technology bundle is significantly less than any of the truck lane bundles** (for both trucks and autos). The least delay benefits occur along the highways closest to the inland region. The reason for this is that the concentration of non-port traffic generators are greater the furthest from the port, in the inland areas. In other words, along the segments furthest from the ports, there are more non-port related trips that consume all of the capacity generated from the removal of port generated trucks, than near the ports. These results are similar to the analysis of the impacts of the Pier-Pass program on the I-710 and other regional highways conducted by the Alameda Corridor

Transportation Authority (ACTA). The impact of the program was greatest on the highways nearest to the ports.

- The advanced technology bundle is more viable if land use policies are strengthened to shift the concentration of warehouse activities around the proposed location of the inland staging facility. This will result in a greater volume of trips to use the dedicated corridor. Land use analyses (described further in Chapter 3) show a concentration of port-related truck trips to and from the San Pedro Bay Ports centered around the SR-60 corridor and focused near the intersection of SR-60 and I-15. **The current distribution of warehouse activities throughout the region limits the successful implementation of an advanced technology corridor.** Strengthened land use guidelines that concentrate warehouse locations around the inland staging area will also improve the delay impact for the highway facilities around the inland staging area, much like the current model results show for the highways around the ports.
  - Without strengthening of land use policies around the location of the proposed inland staging facility, cargo at the staging facility will require transport (likely by truck) to warehouse facilities. This would reduce the benefit of the use of alternative technologies to replace port-to-yard truck trips, as the truck trips would simply be relocated to the areas around the proposed inland staging facility.
- **This finding supports a more comprehensive approach towards corridor development that combines 1) the concept of a fixed guideway, 2) the use of advanced technologies and 3) strengthened land use guidelines.**

Land Use Analysis

The evaluation of land use by project bundle provides additional answers to the following question: What may be the differential effects of the construction of truck lanes on different sub-regions (i.e. the specific types of benefits and impacts that may occur to different sub-regions, depending on facility location)?

Based on data presented in Tech Memo 5b, a strong link between proximity of schools and residences to transportation corridors and public health has been documented. Therefore, the bundles were evaluated to identify the number of schools and amount residential land use adjacent to bundle routes. In addition, connectivity to regional centers of goods movement activity (e.g., ports, warehouses, and distribution centers) is an important factor when considering the development of a regional goods movement system. Therefore, the bundles were also evaluated to identify the amount of warehouse/distribution land use adjacent to bundle routes.

The land use analysis was performed using GIS tools based on existing land use data for the MCGMAP region compiled by SCAG. The land use analysis focused specifically on:

- Proximity to schools and residential land uses.
  - Number of schools within 1/3rd mile (radial) of the bundle route.
  - Acreage of residential land use within ½ mile (radial) of the bundle route.

        - These distances are based on recent studies showing increased risk of health effects due to residents and schools adjacent to goods movement corridors (Described in more detail in Tech Memo 5b).
- Connectivity to warehouse/distribution land uses
    - Acreage of warehouse/distribution land use within one mile (radial) of the bundle route.
        - For the purposes of this analysis, one mile was selected as a reasonable distance for developing direct or limited access routes to the proposed facilities.

Table 4 shows the proximity of schools and residential land uses by bundle.

Table 4
Schools and Residential Land Uses by Bundle within the SCAG Region

Bundle	Description	Schools	Residential (Acres)
2	I-710 to SR-60 to I-15	35	9,933
3	I-710 to I-10 to I-15	60	11,329
4	I-710 to SR-91 to I-15	48	8,684
5	I-710 to I-10 (WB) / SR-60 (EB) to I-15	77	16,702
6	I-710 to SR-91 to SR-57 to SR-60 to I-15	41	10,533
7	I-710 to SR-91 to I-605 to I-10 to I-15	57	11,177
8	I-5 (I-710 to Kern County)	31	4,979
9	I-5 (U.S./Mexico Border to Kern County)	78	12,806
10	I-710 to SR-60 to I-15	35	9,933
12	I-15 (U.S./Mexico Border to Victorville)	23	5,500

As a point of comparison, if I-210 was used as an east-west connection between I-710 (future planned connection) and I-15, a total of 62 schools and approximately 12,200 acres of residential land use would be affected. Along I-210 there are 39 schools and approximately 6,700 acres of residential land between I-710 (future planned connection) and I-15.

The following conclusions can be drawn from Table 4 above:

- The **most schools** would be located along a truck lane system on I-5 extending from the U.S./Mexico Border to the Kern County line (Note: This information excludes San Diego County); a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15 would affect nearly as many schools.
- The **least schools** would be located along a truck lane system on I-15 extending from the U.S./Mexico Border to Victorville (Note: This information excludes

San Diego County); a truck lane system on I-5 extending from I-710 (near downtown Los Angeles) to the Kern County line and a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15 would affect nearly as few schools.

  - For the routes extending from the San Pedro Bay Ports to Victorville, the **most schools** would be located along a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15; a truck lane system that includes I-10 as an east-west connection between I-710 and I-15 would affect nearly as many schools.
  - For the routes extending from the San Pedro Bay Ports to Victorville, the **least schools** would be located along a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15.

- The **most residential land use** would be located along a truck lane system that includes I-10 as an east-west connection between I-710 and I-15.
- The **least residential land use** would be located along a truck lane system on I-5 extending from I-710 (near downtown Los Angeles) to the Kern County line; a truck lane system on I-15 extending from the U.S./Mexico Border to Victorville (Note: This information excludes San Diego County) would affect nearly as little residential land use.
  - For the routes extending from the San Pedro Bay Ports to Victorville, the **most residential land use** would be located along a truck lane system that includes I-10 as an east-west connection between I-710 and I-15.
  - For the routes extending from the San Pedro Bay Ports to Victorville, the **least residential land use** would be located along a truck lane system that includes SR-91 as an east-west connection between I-710 and I-15; a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15 would affect nearly as little residential land use.

Table 5 shows the proximity of warehouse/distribution land uses by bundle.

Table 5
Warehouse/Distribution Land Uses by Bundle within the SCAG Region

Bundle	Description	Warehouse (Acres)
2	I-710 to SR-60 to I-15	6,290
3	I-710 to I-10 to I-15	3,135
4	I-710 to SR-91 to I-15	4,716
5	I-710 to I-10 (WB) / SR-60 (EB) to I-15	6,767
6	I-710 to SR-91 to SR-57 to SR-60 to I-15	5,057
7	I-710 to SR-91 to I-605 to I-10 to I-15	2,691

Table 5
Warehouse/Distribution Land Uses by Bundle within the SCAG Region

Bundle	Description	Warehouse (Acres)
8	I-5 (I-710 to Kern County)	579
9	I-5 (U.S./Mexico Border to Kern County)	3,054
10	I-710 to SR-60 to I-15	6,290
12	I-15 (U.S./Mexico Border to Victorville)	3,151

As a point of comparison, if I-210 was used as an east-west connection between I-710 (future planned connection) and I-15, a total of approximately 1,300 acres of warehouse/distribution land in proximity of the route. Along I-210 there are approximately 95 acres of warehouse/distribution land in proximity of the route between I-710 (future planned connection) and I-15.

The following conclusions can be drawn from Table 5 above:

- The **most warehouse/distribution land use** would be located along a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15; with a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15 having almost as much connectivity.
- The **least warehouse/distribution land use** would be located along a truck lane system on I-5 extending from I-710 (near downtown Los Angeles) to the Kern County line.
    - For the routes extending from the San Pedro Bay Ports to Victorville, the **most warehouse/distribution land use** would be located along a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15; with a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15 having almost as much.
    - For the routes extending from the San Pedro Bay Ports to Victorville, the **least warehouse/distribution land use** would be located along a truck lane system that includes I-10 as an east-west connection between I-710 and I-15; a truck lane system that includes SR-91 as an east-west connection between I-710 and I-15 would have nearly as little connectivity to warehouse/distribution land uses.

Conclusions Based on Travel Demand Model and Land Use Analysis

The application of the travel demand model and land use analysis of the 12 bundles provides answers to the following three questions presented at the beginning of this Tech Memo:

1. Can dedicated truck lanes offer sufficient benefits to be a preferable alternative to other ways of accommodating increased freight traffic (such as adding mixed-flow lanes, adding rail capacity, etc.)?
    a. Operational and safety improvements (including mixed-flow lanes) would not affect a change in truck travel patterns or volumes.
    b. Operational and safety improvements (including mixed-flow lanes) tend to accommodate demand rather than induce increased volumes.
    c. Therefore, truck lanes offer sufficient benefits to be a preferable alternative (in terms of system performance) to operational and safety improvements (including mixed-flow lanes).
    d. While truck lanes offer a better alternative to an advanced technology corridor under the current land use distribution, concentration of warehouse activities around an inland staging area would improve the prospect of an advanced technology corridor.
2. What may be the differential effects of the construction of truck lanes on different sub-regions (i.e. the specific types of benefits and impacts that may occur to different sub-regions, depending on facility location)?
    a. The truck lane concepts that include an east-west connection between I-710 and I-15 are the most varied in terms of potential affects to different subregions.
        i. When examined in terms of truck volumes, vehicle volumes, proximity to schools and residential land uses, and connectivity to warehouse/distribution land uses, SR-60 as an east-west connection between I-710 and I-15:
            1. Would carry the highest truck volumes.
            2. Would carry very high vehicle volumes (compared to other options).
            3. Would affect the least number of schools.
            4. Would affect the least amount of residential land uses.
            5. Would provide the most connectivity to warehouse/distribution land uses.
                a. As stated previously, all truck lane bundles show comparable reductions in hours of delay for trucks, therefore,, changes to congested hours of delay for trucks is not referenced.
3. To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?

a. Similar to the response to the first question above, truck lanes offer sufficient benefits to be a preferable alternative (in terms of system performance) to operational and safety improvements (including mixed-flow lanes).
b. The costs of truck lane alternatives are evaluated in Chapter 3.
c. More detailed information and analyses would be required in order to accurately respond to the question, particularly in the area of air quality improvements and associated costs.

Chapter 3 – Potential Revenue Generation and Cost Estimate

Evaluation of Potential Revenue Generation

An evaluation of tolling and potential revenue generation begins to answer the following question: What portion of dedicated truck lane costs could be offset by user financing, and what additional revenues or funding sources would be needed to support dedicated truck lanes?

An analysis of revenue generation potential of a truck lane system that includes an east-west connection between I-710 and I-15 under tolling scenarios was performed. The results are summarized in Table 6 below. The tolling analyses were carried out using travel demand model output data received from SCAG. As described in Chapter 2 and as defined by the Modeling Working Group, SCAG ran the travel demand model for each bundle. The model output was provided to the project team for further analysis. All tolling analyses were performed external to SCAG's travel demand model. Therefore, the tolling analysis was not able to evaluate changes in vehicle volumes and trip characteristics (e.g., the output of the tolling analysis could not be input into SCAG's travel demand model and then reevaluated under SCAG's model).

In general, it was found that the greatest revenue generation potential occurs when a toll rate of $0.20, $0.40, and $0.60 per mile is applied to light- (LHDT), medium- (MHDT), and heavy-duty trucks (HHDT), respectively.

Table 6
Potential Toll Revenue Generation Year 2030
for a Truck Lane System that Includes an East-West Connection between I-710 and I-15

Toll Rate ($LHDT / $MHDT / $HHDT)	Annual Revenue ($millions)					
	Bundle 2	Bundle 3	Bundle 4	Bundle 5	Bundle 6	Bundle 7
.10/.20/.30	199.5	197.8	177.0	199.7	177.9	185.0
.15/.30/.45	240.4	239.4	215.3	241.3	213.6	224.1
.20/.40/.60	255.0	254.3	231.1	256.5	226.5	239.4
.25/.50/.75	253.1	250.5	230.1	253.5	222.3	236.5
.30/.60/.90	245.1	242.6	223.9	242.7	213.5	225.3

The toll revenue generation estimates presented above are primarily based on estimated vehicle miles of travel (VMT) along specified routes. Table 7 summarizes VMT estimates by bundle and toll rate.

Table 7
Projected Vehicle Miles of Travel (VMT) Year 2030
for a Truck Lane System that Includes an East-West Connection between I-710 and I-15

Toll Rate ($LHDT / $MHDT / $HHDT)	Annual VMT					
	Bundle 2	Bundle 3	Bundle 4	Bundle 5	Bundle 6	Bundle 7
.10/.20/.30	736,395	725,509	651,808	734,829	653,441	677,672
.15/.30/.45	599,428	592,726	534,872	599,596	529,583	553,704
.20/.40/.60	484,268	479,133	436,544	485,262	427,364	449,749
.25/.50/.75	391,094	383,603	353,326	390,053	341,301	361,083
.30/.60/.90	321,108	314,645	290,926	316,501	277,686	291,480

Table 8 below shows the share of total trucks using the toll lanes along specified routes by project bundle. Due to the methodology for evaluation of the truck toll lanes developed by the MCGMAP project team, the truck toll lanes are assumed to have a number of access points at key locations along each bundle route. Therefore, the truck toll lanes will be most effective on capturing the more diffuse truck trips within the region (e.g., truck trips that are not tied to a specific route or origin-destination pair). This is highlighted by the percent share of trucks shown on Table 8. The highest market share of trucks is occurring along those routes that serve multiple destinations and multiple truck travel purposes (e.g., local distribution, port drayage, regional distribution).

Table 8
Percent Trucks Using Toll Lanes for Each Bundle - Year 2030

Bundle	Description	Toll Market Share for Specific Segments
2	I-710 to SR-60 to I-15	I-710 – 25% to 65%(1); SR 60 – 40%; I-15 – 18%-28%(2)
3	I-710 to I-10 to I-15	I-710 – 33% to 77%(1); I-10 – 50%; I-15 – 14%-30%(2)
4	I-710 to SR-91 to I-15	I-710 – 29% to 35%; SR 91 – 27%-30%; I-15 – 16%-43%(2)
5	I-710 to I-10 (WB) / SR-60 (EB) to I-15	I-710 – 30% to 50%(1); SR 60/I-10 – 30%; I-15 – 14%-30%(2)
6	I-710 to SR-91 to SR-57 to SR-60 to I-15	I-710 – 30% to 33%; SR 91 – 30%; SR 60 – 25%-43%; I-15 – 16%-43%(2)
7	I-710 to SR-91 to I-605 to I-10 to I-15	I-710 – 30%; I-605 - 25%; I-10 – 28%-35%; I-15 – 14%-28%(2)

(1) Highest share towards northern end of I-710.
(2) Lowest share towards northern end of I-15.

Based on Tables 6, 7 and 8 above, the following conclusions can be made regarding potential toll revenue generating potential:

- The **greatest toll revenue generation potential** would result from a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15; truck lane systems that include SR-60 or I-10 as an east-west connection between I-710 and I-15 provide nearly an equal amount of revenue generating potential.

- The **least toll revenue generation potential** would result from a truck lane system that includes SR-91, SR-57, and SR-60 as an east-west connection between I-710 and I-15; truck lane systems that include SR-91 as an east-west connection between I-710 and I-15 provide the least amount of revenue generating potential.

Evaluation of Longer Combination Vehicles

An evaluation of the use of longer combination vehicles (LCV) begins to answer the following question: What policy changes would facilitate or enhance truck lane feasibility (e.g., LCV's, mandatory use, etc.)?

An evaluation of the use of longer combination vehicles (LCV) was also conducted as a subset of the toll revenue analysis. Whereas the toll revenue analysis to this point focused on the tolling of standard trucks on dedicated facilities, the purpose of the LCV evaluation is to determine whether toll revenue can be enhanced through productivity gains by allowing LCV's on dedicated facilities to offset the cost of a toll. The FHWA defines two particular types of LCV configurations: A "Triple Short" and a "Double Long" that could carry 50% and 100% more tonnage, respectively, than standard truck units. A Triple Short LCV combination consists of a tractor and three trailers in tow, typically three 28 to 28.5 foot trailers. The Double Short (also known as the Turnpike Double) consists of a truck-tractor towing two long trailers of equal length, typically two 48 or 53 foot trailers. A total of 14 States currently have provisions for LCV use and are included in this study: Alaska, Arizona, Colorado, Idaho, Montana, Nebraska, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, Wyoming[1]. LCV's are not permitted anywhere in California. Furthermore, there is significant local opposition to the use of LCV's on local roadways in the study area[2]. This opposition creates barriers for the integration of LCVs on the State highway system, as staging areas would be required to avoid local roads if local opposition or resolutions forbade the use of LCVs on local roadways. Therefore, a potential LCV system would likely require direct, dedicated access to staging areas where trucks could be converted to and from LCV configurations.

Two different methods were used to evaluate this potential market. The first approach, which is similar to the approach utilized for the *I-15 Comprehensive Corridor Study* prepared for SCAG, SANBAG and Caltrans (December, 2005), evaluates commodity-specific information to determine the potential LCV market on the premise that only specific commodities would benefit from a longer vehicle combination. The commodity-specific approach is used to identify trips of more than 100 miles, to and from the study area, and primarily trips defined as domestic, as well as secondary trips in and out of the region. The second approach evaluates the international container market through the ports of Long Beach and Los Angeles, and focuses specifically on the portion of trips that stay within the region, specifically first order trips between the port and staging areas.

Evaluation of the Long-Haul LCV Market Potential

Commodity flow data from Caltrans' Intermodal Transportation Management System (ITMS) was used along with the payload data from SCAG's Heavy Duty Truck (HDT) model for calculating the truck volumes. The ITMS data base provided estimates of 2030 Commodity Flow within/entering/exiting the region. Only trips longer than 100 miles are considered to be eligible. Considering the complexities of cross-border commerce and infrastructure differences of different countries, goods to/from Canada and Mexico were excluded in the analysis. Finally, due to the potential lack of continued provision of LCV facilities in the central parts of the United States, goods to/from northeastern and southeastern States were also taken out of the LCV data set.

The SCAG Regional LCV eligible goods were converted to standard truck units using the SCAG HDT model payload parameters. The LCV Triple Short and Double Long truckloads were then calculated by applying 1.5 and 2.0 factors to the standard truckloads. Assuming LCV facilities are available in year 2030 for either Triple Short or Double Long within the SCAG region and are required for use by long haul (over 100 miles) LCVs, an average LCV trip length of 74 miles was used to calculate the LCV VMT (representing the VMT of LCVs within the SCAG region). Note that the average trip length of 74 accounts for the distances from the geo-center point of the SCAG Region (the region covered by the modeling data utilized) to the peripheral of the SCAG Region along major highways. Based on this evaluation, and estimated 22.7 million annual standard truck loads are considered as convertible to LCV, representing a 14% share of the total study area truck market based on the SCAG model for 2030 (approximately 162 million annual standard truck loads). This market share estimate is conservative compared to studies by the Transportation Research Board (TRB) and the Bureau of Transportation Statistics (BTS). The table below shows the potential LCV convertible market for low density goods and high density goods based on these studies.

Table 9
LCV Market Conversion Rates Based on National Studies

	TRB*	BTS**
Low Density Goods	11-21%	31-51%
High Density Goods	33%	23-36%

*Source: The Productivity Effects of Truck Size and Weight Policies; Bureau of Transportation Statistics, U.S. Department of Transportation, November 1994.
** Source: Special Report 227; Transportation Research Board, 1990.

Given that the likely scenario for LCV corridor development would initially be isolated to the corridor between the ports and Victorville, further analysis was conducted to determine the share of the potential convertible LCV market that would use the corridor. Based on an evaluation of the overall truck market for the study area, it was determined that this corridor handles approximately 10% of the region's truck volumes, based on annual truck trips. Applying this factor to the overall LCV market yields an estimate of 2.3 million annual standard truck loads convertible to LCV along this corridor, reducing the effective market share to 1.4% of the entire study area truck market. The following table summarizes the SCAG region LCV market as well as for the corridor between the ports and Victorville. This served as the basis for revenue estimates performed for LCVs.

Table 10
2030 SCAG Region LCV Volume & VMT from Long-Haul Truck Market

	Annual Standard Truckloads	Annual LCV Truckloads		Annual LCV VMT*	
		Triple Short	Double Long	Triple Short	Double Long
SCAG Total	162,240,100	N/A	N/A	N/A	N/A
SCAG Region (Eligible for LCV conversion)	22,713,618	15,142,423	11,356,821	1,120,539,302	840,404,754
Bundle 2 Corridor	2,271,362	1,514,255	1,135,693	148,396,990	111,297,914

Note: * Assume Average trip length of 74 miles within the SCAG region and 98 miles for the Corridor.

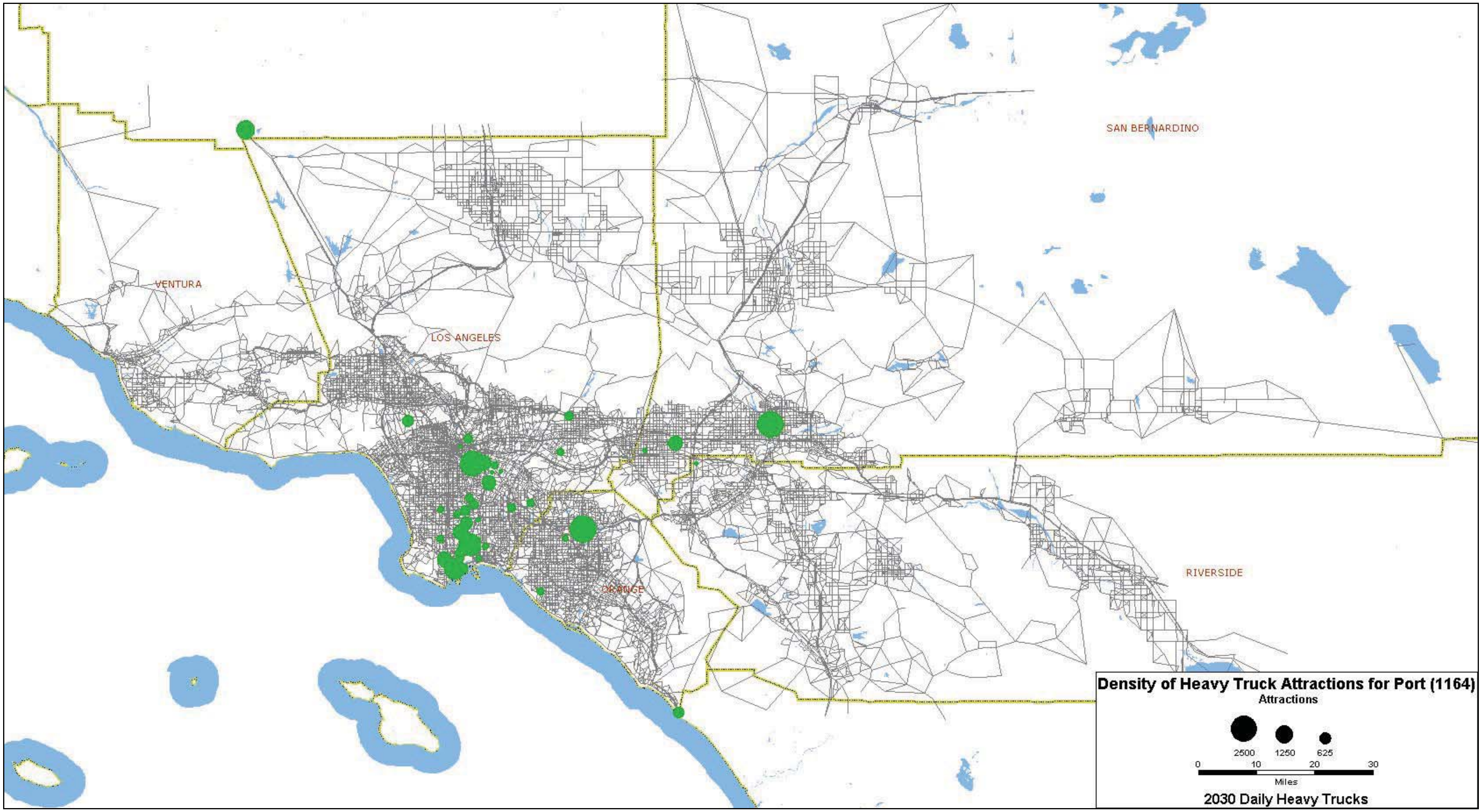
In the *I-15 Comprehensive Corridor Study*, potential LCV revenue estimates were based on the savings achieved by comparing the cost of using a semi-trailer versus a Triple Short, and a double short vs. a Double Long. A third of the savings by using LCV is assumed to be applied to tolls as toll revenue, while the other two thirds were split between shippers and truckers. The report provided a per-mile toll rate of $0.37 for the Triple Short LCV configuration and $0.89 for the Double Long LCV configuration (in year 2000 dollars).

By applying the Consumer Price Index (CPI) based inflation adjustment to the above toll rates, the year 2006 LCV per-mile toll rates come to $0.43 (Triple Short) and $1.04 (Double Long). **Therefore, the 2030 LCV revenue for the corridor from the Ports to Victorville is estimated to be $64 million if only the Triple Short configuration is used, or $116 million if only the Double Long configuration is used.** This revenue generation potential assumes LCVs would be allowed along one of the identified truck lane systems (specifically bundle 2 in this evaluation).

Evaluation of the Intra-Regional LCV Market Potential

Although currently not in practice, and not withstanding the technological and institutional hurdles to implementing double chassis for container trucks, an evaluation of the potential market for port container trucks as an LCV (by assuming trucks are configured to carry double container chassis) was conducted. The evaluation was conducted based on the unique nature of this market segment. Unlike the attractors and generators of domestic truck traffic which are scattered throughout the region, the attractors and generators of port related truck traffic are somewhat more concentrated, as is shown in the map in Figure 21. Therefore, the truck volumes for this market tend to utilize a limited number of facilities, specifically the corridor from the ports to Victorville. And although the volumes do drop significantly further from the port, there are specific locations along this corridor that represent major

Figure 21
Attraction Density of Heavy Trucks (Daily 2030) from Port (TAZ 1164)



concentrations of volumes. Based on the evaluation of the port truck trip data, these locations include the area around the Hobart intermodal facility east of Los Angeles, the concentrated warehouse and distribution facilities between downtown Los Angeles and Ontario, the intersection of I-10 and I-15, and the area around Victorville. These areas were identified as the inland nodes in evaluating the potential VMT and associated revenue generating potential of LCVs to and from the San Pedro Bay Ports and inland destinations.

Given that trucks would use the LCV facility only for a portion of their trip, based on variety of factors such as destination as well as congestion levels on competing facilities, truck trip distances on the separated truck facility, and the associated revenue, were based on the shortest "skimmed" path during congested peak times. Trips with a "skimmed" distance on the actual facility of less than 10 miles were eliminated. Based on the analysis, approximately 26% of the port container market in 2030 is potentially convertible to LCVs, which equates to approximately 32,227 trips per day. Note that this market share estimate is conservative when compared to the earlier mentioned TRB and BTS studies. The following table shows the estimated port container LCV market in 2030, shown as daily truck trips.

Table 11
Port Container LCV Market – Daily Truck Trips (2030)

	From Ports	To Ports	Total
Total Daily Port Truck Trips*	63,051	60,277	123,328
Potential LCV Convertible Trips	20,528	11,699	32,227
Market Share	33%	19%	26%

* Source: SCAG Port Truck Trip Model.

The following table summarizes the estimated annual VMTs for port related LCV's along the Bundle 2 Corridor, and associated revenues, using a toll rate of $1.04 per mile for a Double configuration.

Table 12
VMT and Revenue Estimates for Container Truck LCVs

General Location of Staging Area	Daily Miles Traveled On LCV Facility (VMT)		Annual Toll Revenue ($millions)
	Standard Trucks	Double LCV	
Victorville (via I-15)	88,430	44,215	13.8
Colton/I-15 (via SR-60)	873,962	436,981	136.3
Covina (via SR-60)	87,892	43,946	13.7
Hobart/East LA (via I-710 & SR-60)	180,757	90,379	28.2
TOTAL	1,231,042	615,521	192.0

Combined LCV Market Potential

It is likely that the port container LCV trips to/from Victorville are external to the region and may potentially be included in the long haul LCV market estimates. Therefore the adjusted LCV market in 2030 is estimated at 38,896 standard trucks daily (7,571 for the long-haul market and 32,227 for the port container market), an adjusted market share of seven percent of the entire truck market in the region in 2030. Total potential annual revenue is estimated at $308 million ($116 million from the long-haul market and $192 million from the port container market).

It is important to note that the LCV toll facilities would also be open to standard trucks willing to pay the conventional truck toll rate. The LCV market revenue estimates do not include the potential revenue from standard trucks using the LCV toll facilities. Therefore, the current estimate under the LCV market scenario is conservative. By including standard trucks, the potential revenue will increase by some portion of $255 million, but not by the full amount, for several reasons, including:

- Some share of the standard trucks willing to pay a toll under the conventional toll scenarios are candidates for the LCV market, and are therefore included in the LCV revenue estimates.
- Under the LCV scenarios, the congestion levels on the general purpose lanes would improve, thereby reducing the incentive for some of the standard trucks that were willing to pay the toll.

Attracting 25% of the conventionally tolled trucks into the LCV lanes would generate an additional $63.75 million, for a total of $371.75 million; a 50% capture rate would generate an additional $127.50 million (total of $435.50 million) and a 75% capture rate would generate an additional $191.25 million (total of $499.25 million).

Evaluation of Container Fees

The project team also investigated the revenue generation potential of container fees. For the purposes of the study, two scenarios for potential bonding capacity were evaluated, each based on container fees per Forty-foot Equivalent Unit (FEU). The two scenarios evaluated were:

1. Revenue bonding capacity based on container fees levied for all container movement through the San Pedro Bay ports.
2. Bonding capacity based on container fees levied for only those containers that would travel on a separate facility using an alternative technology.

For the first scenario, the three forecasts (Low or 12.25 million FEUs, Medium or 16.65 million FEUs, and High or 21.25 million FEUs) of container cargo through the San Pedro Bay ports (as described under the discussion of Scenarios in Chapter 1) were used along with a series of container fee levels (per FEU) to calculate potential revenue bonding capacity. Container fees of $10, $20, $30, $40, $50, $100, and $200 per FEU were used.

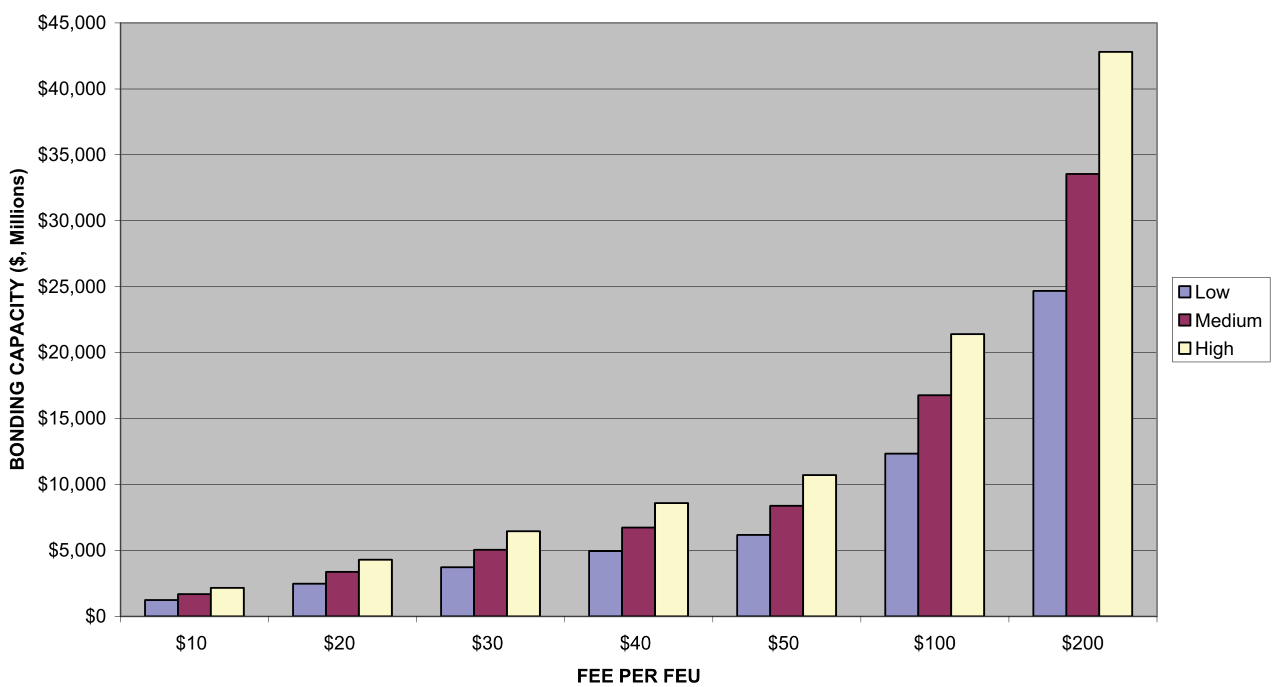
Key assumptions in the estimates of container fees and associated revenue bonding capacity were:

- A debt coverage rate of 1.4 was assumed for all projects.
- Bonds would be issued at an interest rate of 5.75 percent with a 30 year repayment schedule.
- No transaction fees, debt service costs, or debt service reserves have been included at this time, but would be included in future financial strategy development.
- As a rough estimate, the level of bond proceeds that could be issued under the truck toll projects was estimated to be roughly equal to 14 times the net revenue available for payment of debt service, assuming a 1.4 coverage ratio.
- In the absence of a real cost or schedule, the analysis was done in constant dollars. Any future financial strategy development would be based on refined project cost estimates and a proposed project implementation schedule and would be based on year of expenditure dollars.

Using the highest container cargo forecast (42.5 million TEUs, or 21.25 million FEUs) and the highest container fee ($200 per FEU), a bonding capacity of $42.8 billion was estimated. Using the lowest container cargo forecast (24.5 million TEUs, or 12.25 million FEUs) and the lowest container fee ($10 per FEU), a bonding capacity of $1.2 billion was estimated. Figure 22 below presents a summary of potential revenue bonding levels and container fees.

Figure 22

**POTENTIAL BONDING CAPACITY FROM CONTAINER FEES
RANGE OF CONTAINER (FEU) FEE: $10 - $200 PER FEU
2030 PROJECTION OF FEU'S: LOW, MEDIUM, AND HIGH
(in Millions)**

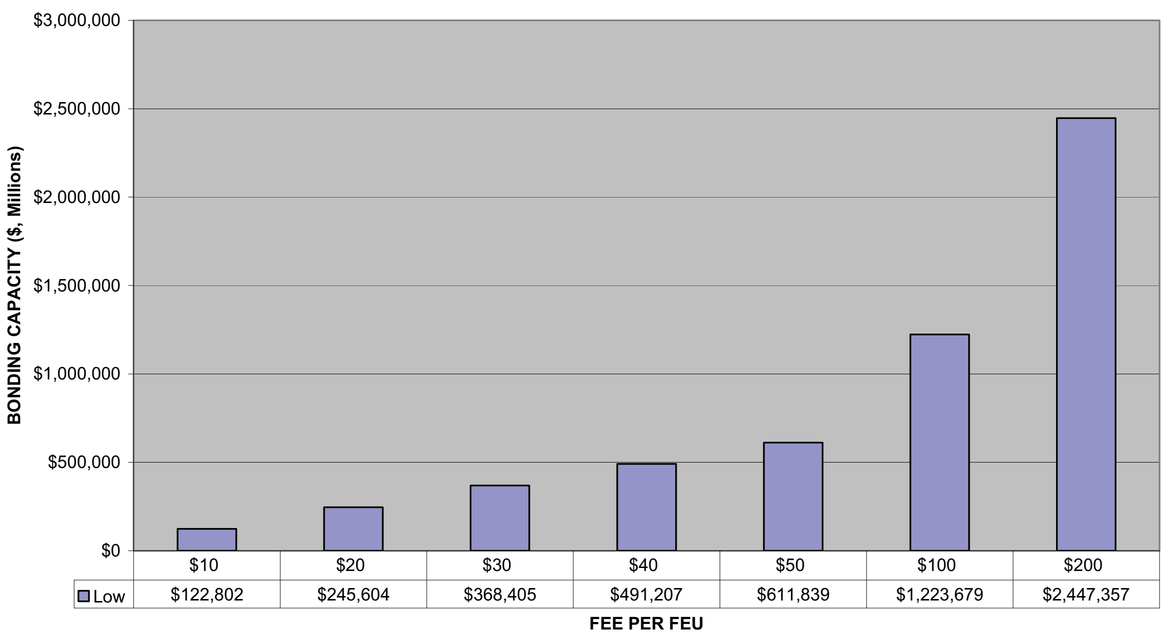


Source: Sharon Greene Associates, 2007

For the second scenario, an alternative technology system connecting the San Pedro Bay ports and an inland staging yard, as described under the modeling of Bundle 11 in Chapter 2, was used to calculate potential bonding capacity. It was assumed that the alternative technology system would accommodate approximately 1,215,000 FEUs per year (equivalent to the existing Hobart yard). Container fees of $10, $20, $30, $40, $50, $100, and $200 per FEU were used. The analysis showed a potential bonding capacity between $122 million and $2.45 billion, depending on the container fee. Figure 23 below presents a summary of bonding capacities and container fees.

Figure 23

POTENTIAL BONDING CAPACITY FROM CONTAINER FEES
RANGE OF FEE PER FEU: $10 - $200 PER FEU
PROJECTED FEU'S: 1,215,000
($, 000)



Source: Sharon Greene Associates, 2007

Note that the current fee program being proposed by the ports of Los Angeles and Long Beach involves a "pay-as-you-go" program without the need for borrowing. The advantage of this approach is two-fold. First, the project owner/sponsor can avoid substantial borrowing costs such as interest and other financing fees. Second, the term of the fee is reduced, reducing the burden on the project owner/sponsor and on the fee contributors. This approach is especially possible in this specific port area because of the high volumes of container traffic.

Conclusions Based on Potential Revenue Generation

Truck Toll Revenue

Based on the evaluation of potential revenue generation by truck lane bundles, the following conclusions are made:

- The **greatest toll revenue generation potential** (in terms of truck tolls) would result from a truck lane system that includes both SR-60 (in the eastbound direction) and I-10 (in the westbound direction) as an east-west connection between I-710 and I-15 (approximately $257 million annual toll revenue) allowing for a potential bonding capacity of approximately $3.5 billion; truck lane systems that include SR-60 or I-10 as an east-west connection between I-710 and I-15 provide nearly an equal amount of revenue generating potential (approximately $255 million annual toll revenue) allowing for a potential bonding capacity of approximately $3.5 billion.
- The use of LCVs on dedicated facilities could increase annual revenue generation to $308 million, allowing for a potential bonding capacity of more than $4 billion. Moreover, allowing standard trucks to use the LCV facility will further increase revenues to as much as $500 million. (Note that the modeling methodology used to calculate LCV toll revenue potential did not allow for an accurate analysis of additional revenue potential from non-LCVs using the dedicated facilities.) Developing the LCV facilities from the port to as far as Victorville will maximize its revenue potential by optimally targeting three market segments:
    - The long haul LCV market.
    - The port container LCV market.
    - The remaining standard truck market willing to pay tolls.

Container Fees

- Container fees levied on all containers through the San Pedro Bay ports could allow for a bonding capacity between $1.2 billion and $42.8 billion, depending on the volume of containers and the amount of fee.
- An alternative technology system could impose container fees for those containers using the facility and generate between $122 million and $2.45 billion, depending on the amount of fee.

Truck Lane Cost Estimates

The cost of truck lane systems is required in order to complete the answer to the following question: What portion of dedicated truck lane costs could be offset by user financing, and what additional revenues or funding sources would be needed to support dedicated truck lanes?

Based on previous studies, a per lane mile cost for new facility construction is estimated to be between $6.43 million and $32.44 million, as summarized below. These costs assume new construction, preliminary studies, and right-of-way acquisition:

- An evaluation of planned truck lane projects (excluding preliminary cost estimates for truck lanes on I-710), an average cost of $6.43 million per lane-mile is determined.
- An evaluation of all project costs (including truck lanes and mainline additions) shows an average cost of $32.44 million per lane-mile.
- Based on the cost data presented in the *Briefing Paper - User-Supported Regional Truckways in Southern California* (SCAG, 2004), an average cost of $28.45 million per lane mile was calculated for the regional truck lane system evaluated along I-710, SR-60, and I-15 (from the San Pedro Bay Ports to Barstow).
- It is assumed that given current right-of-way acquisition costs in the urban areas of Southern California, costs of $40 million to $50 million per lane-mile of new facility would not be unreasonable; therefore, a cost of $45 million per lane-mile is taken as a "theoretical maximum" for truck lane construction.

Note that the cost estimates are prepared at a regional level for comparison purposes only. Detailed engineering cost estimates of specific facilities could show great variation, particularly in terms of right-of-way acquisition costs between urban and suburban/rural areas. In addition, utility relocation costs or other location-specific costs (e.g., environmental or cultural resource impacts) could substantially impact facility costs.

Therefore, the following range of costs is identified for the identified project bundles that include a truck lane system:

Table 13
Cost Estimates for Truck Lane Systems

Bundle	Description	Distance (mi)	Lanes	Lane-mi	Lowest Cost / lane-mi ($Mil)	Lowest Cost ($Mil)	SCAG-Based Cost / lane-mi ($Mil)	SCAG-Based Cost ($Mil)	Average Cost / lane-mi ($Mil)	Average Cost ($Mil)	Highest Cost / lane-mi ($Mil)	Highest Cost ($Mil)	Theoretical Maximum Cost / lane-mi ($Mil)	Theoretical Maximum Cost ($Mil)
2	I-710 to SR-60 to I-15	101.5	4	406.0	$6.43	$2,611.69	$28.45	$11,549.56	$26.70	$10,839.14	$32.44	$13,170.06	$45.00	$18,268.20
3	I-710 to I-10 to I-15	98.7	4	394.8	$6.43	$2,539.90	$28.45	$11,232.06	$26.70	$10,541.17	$32.44	$12,808.01	$45.00	$17,766.00
4	I-710 to SR-91 to I-15	87.5	4	349.9	$6.43	$2,250.91	$28.45	$9,954.09	$26.70	$9,341.81	$32.44	$11,350.73	$45.00	$15,744.60
5	I-710 to I-10 (WB) / SR-60 (EB) to I-15	100.1	4	400.4	$6.43	$2,575.79	$28.45	$11,390.81	$26.70	$10,690.16	$32.44	$12,989.04	$45.00	$18,017.10
6	I-710 to SR-91 to SR-57 to SR-60 to I-15	110.0	4	439.8	$6.43	$2,829.65	$28.45	$12,513.45	$26.70	$11,743.74	$32.44	$14,269.19	$45.00	$19,792.80
7	I-710 to SR-91 to I-605 to I-10 to I-15	96.1	4	384.3	$6.43	$2,472.22	$28.45	$10,932.77	$26.70	$10,260.29	$32.44	$12,466.73	$45.00	$17,292.60
8	I-5 (I-710 to Kern County)	74.6	4	298.4	$6.43	$1,919.46	$28.45	$8,488.34	$26.70	$7,966.22	$32.44	$9,679.33	$45.00	$13,426.20
9	I-5 (U.S./Mexico Border to Kern County)	204.6	4	818.4	$6.43	$5,264.82	$28.45	$23,282.34	$26.70	$21,850.24	$32.44	$26,549.05	$45.00	$36,826.20
12	I-15 (U.S./Mexico Border to Victorville)	161.7	4	646.8	$6.43	$4,160.85	$28.45	$18,400.32	$26.70	$17,268.51	$32.44	$20,982.04	$45.00	$29,104.20

Conclusions Based on Cost Estimates

Based on the cost estimates for truck lane systems, the following conclusions are made:

- The **least costly** truck lane system would be on I-5 extending from I-710 (near downtown Los Angeles) to the Kern County line.
- The **most costly** truck lane system would be on I-5 extending from the U.S./Mexico Border to the Kern County line.
  - For the routes extending from the San Pedro Bay Ports to Victorville, the **least costly** would be a truck lane system that includes SR-91 as an east-west connection between I-710 and I-15.
  - For the routes extending from the San Pedro Bay Ports to Victorville, the **most costly** would be a truck lane system that includes both SR-91, SR-57, and SR-60 as east-west connections between I-710 and I-15.

The cost estimates provide additional information to respond to the question: To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? The costs for truck lane systems will be factored into the review of system performance in order to respond to this question.

Based on the earlier evaluation of system performance and land use (described in Chapter 2), it was clear that a truck lane system that includes SR-60 as an east-west connection between I-710 and I-15 offers the best performance for a dedicated truck lane system accessing warehouse and distribution land uses. Therefore, when combined with the evaluation of toll revenue generating potential and the estimate of truck system costs, an answer to the following question presented at the beginning of this Tech Memo is provided:

1. What portion of dedicated truck lane costs could be offset by user financing, and what additional revenues or funding sources would be needed to support dedicated truck lanes?
   a. The response assumes the recommendation of a truck lane system comprised of dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to SR-60), SR-60 (I-710 to I-15), and I-15 (SR-60 to Victorville).
      i. **As shown in the table below, toll revenues provide a bonding capacity of between 33% and 58% of the project cost.** Bonds leveraged from anticipated toll revenue could potentially be a component of the funding and financing proposed for the truck toll lane projects. This conclusion is preliminary and not based on a detailed financial analysis.

Table 14
Estimated Bonding Capacity from Truck Toll Lanes
($ Billion)

	Toll Revenue	Toll Revenue Bonds	% of Project Cost
Conventional Truck Toll	$255	$3,595	33%
LCV Truck Toll	$308	$4,371	40%
Combined LCV/Truck Toll	$436	$6,237	58%

Note that since cost data and traffic forecasts are only conceptual at this time, the toll revenue and bonding potential described above should only be considered as order of magnitude estimates. The following assumptions were used to generate order of magnitude toll revenue bond estimates for each of the truck lane projects:

- Costs for constructing the project is assumed to be $10.839 billion, the average of the range previously described ($2.6 billion to $18.3 billion).
- Annual O&M costs assumed to range between $6.2 Million/year at the low end and $13.6 Million/year at the high end.
- Debt Coverage Ratio of 1.4 times.
- Toll revenue for first year of operations are $255 million for the conventional truck toll, $308 million for the LCV toll and $436 for the combined toll (100% of the LCV revenue and 50% of the conventional truck toll).
- Toll revenue is assumed to grow by 110% over 30 year period.
- Bonds would be issued at an interest rate of 5.75 percent with a 30 year repayment schedule.
- Amortization over 30 years, with project starting in 2030.
- No transaction fees, debt service costs, or debt service reserves have been included at this time, but would be included in future financial strategy development.
- In the absence of a real cost or schedule, the analysis was done in constant dollars. Any future financial strategy development would be based on refined project cost estimates and a proposed project implementation schedule and would be based on year of expenditure dollars.

Using a 40 year amortization could increase the bonding capacity by a further 13%, from 33% to 38% under the conventional toll, and from 58% to 65%.

Results of Detailed Evaluation

As stated in the beginning of this Tech Memo, the purpose of the detailed evaluation is to answer specific questions. The questions are listed below with the answers following:

- To what extent may dedicated truck lanes (continuous or for selected major subsections of freeway) offer sufficient economic and other benefits (improved efficiency, greater safety/reduced accident costs, improved air quality) in relation to their cost? In other words, would they be a cost-effective investment?
  - In terms of economic benefits, it is clear that additional investment in the transportation system beyond current levels will be required in order to accommodate the forecast growth in container cargo volumes through the San Pedro Bay Ports; otherwise, the system will be constrained and will perform at less than optimal levels. The forecast growth in container cargo will result in increased truck traffic on the MCGMAP Region's highway system. Therefore, not accommodating the additional truck traffic could lead to less than expected growth in container cargo, which could lead to the reduced job creation forecasts discussed above and a related economic impact; conversely, accommodating truck traffic will lead to economic benefits.
  - Truck lanes offer sufficient benefits to be a preferable alternative (in terms of system performance) to operational and safety improvements (including mixed-flow lanes).
  - More detailed information and analyses would be required in order to accurately respond to the question, particularly in the area of air quality improvements and associated costs.
    - **Therefore, dedicated truck lanes could offer sufficient economic and efficiency (system performance) benefits, however, subject to demonstration of cost-effectiveness and financial feasibility.**

- What portion of dedicated truck lane costs could be offset by user financing, and what additional revenues or funding sources would be needed to support dedicated truck lanes?
  - The response assumes the recommendation of a truck lane system comprised of dedicated truck lanes (2 lanes in each direction) on I-710 (Ports to SR-60), SR-60 (I-710 to I-15), and I-15 (SR-60 to Victorville).
    - **Approximately 33% to 58% of the project cost could be offset by user financing. Container fees could serve as an additional revenue source.**

- What policy changes would facilitate or enhance truck lane feasibility? (e.g., LCV's, mandatory use, etc.)?
  - LCV provisions would increase revenue generation potential and would enhance truck lane feasibility; however, a number of concerns regarding safety, legality, etc. would need to be addressed:
    - The state of California does not allow LCV's on its highways.
    - There is local community resistance to the use of LCV's.
    - A separate truck highway facility will need to be constructed with requisite staging areas to allow trucks to build and breakdown the configurations in order to comply with standards on the general purpose system.
    - The port container LCV market will need further innovation to improve the operations of standard container chassis to operate safely as LCV's.

- Can dedicated truck lanes offer sufficient benefits to be a preferable alternative to other ways of accommodating increased freight traffic (such as adding mixed-flow lanes, adding rail capacity, etc.)?
  - Operational and safety improvements (including mixed-flow lanes) would not affect a change in truck travel patterns or volumes.
  - Operational and safety improvements (including mixed-flow lanes) tend to accommodate demand rather than induce increased volumes.
    - **Therefore, truck lanes offer sufficient benefits to be a preferable alternative to accommodating increased freight traffic, as they would affect the most substantial change on truck travel patterns and volumes on the roadways within the MCGMAP Region.**
  - An advanced technology corridor could be a viable alternative if land use guidelines and policies are strengthened to encourage warehouse clustering near inland staging areas.

- What may be the differential effects of the construction of truck lanes on different sub-regions (i.e. the specific types of benefits and impacts that may occur to different sub-regions, depending on facility location)?
  - The truck lane concepts that include an east-west connection between I-710 and I-15 are the most varied in terms of potential affects to different subregions.
  - When examined in terms of truck volumes, vehicle volumes, changes to congested hours of delay, proximity to schools and residential land uses, and connectivity to warehouse/distribution land uses, SR-60 clearly offers the best performance because of the following:

- A truck lane system includes SR-60 as an east-west connection between I-710 and I-15 would carry the highest truck volumes.
- A truck lane system includes SR-60 as an east-west connection between I-710 and I-15 would carry very high vehicle volumes (compared to other options).
- A truck lane system includes SR-60 as an east-west connection between I-710 and I-15 would affect the least number of schools.
- A truck lane system includes SR-60 as an east-west connection between I-710 and I-15 would affect the least amount of residential land uses.
- A truck lane system includes SR-60 as an east-west connection between I-710 and I-15 would provide the most connectivity to warehouse/distribution land uses.
- **Therefore, a truck lane system from the San Pedro Bay Ports to Victorville on I-710, SR-60, and I-15 would be the preferred option.**
    - **NOTE: SEE UPDATED DISCUSSION IN VOLUME 1 EXECUTIVE SUMMARY**

[1] Source: U.S. GAO Longer Combination Vehicles, Washington D.C., 1994.

[2] Resolution No. C – 28387 – A resolution of the City Council of the City of Long Beach voicing opposition to the operation of longer combination vehicles (LCV) within the jurisdiction of the City of Long Beach, June 15, 2004.